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THE TEACHING OF HANDWRITING

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EDITOR'S INTRODUCTION

TRADITION has dominated the teaching of handwriting as it has no other school study. It has been the last of the so-called formal subjects to be influenced by the newer educational thought. Aside from the notable but temporary controversy as to vertical or slant writing, the pedagogy of penmanship has scarcely been an important concern in educational discussion. Not until quite recently have we really had any important professional publications upon the subject. The result has been a tardy development of economical and efficient methods of teaching children to write.

It would be a mistake to imply that teachers have not been conscious of the problems involved in the teaching of handwriting. They have. Every teacher is aware of the controversies as to slant, size, position, movement, speed, accuracy, etc. They are part of the craft troubles of every pedagogue, inherited along with traditions of technique and subject-matter. But it must be frankly admitted that teachers as a class have

been complacent about these matters. At least they have given far less energy to the solution of these disputes than they have to similar ones in reading, spelling, and arithmetic. This attitude is a little difficult to explain, particularly when it is understood that bad penmanship, like poor spelling, constitutes one of the readiest means of attacking the efficiency of teachers. It is probable that the ordinary experiences of teachers were incapable of rendering the necessary decisions. A more expert psychological analysis and a more careful pedagogical experimentation than ordinary teachers were able to conduct were needed to illumine the situation. This seems to be borne out by the fact that interest in the pedagogy of writing began to stir the moment an educational psychology and an experimental pedagogy began to be developed.

Until very recently such innovations as appeared in the teaching of penmanship were introduced by those whose prime interest in the matter was commercial rather than professional. A new system of penmanship had to have some new idea to commend it above its predecessors. In consequence penmanship has been overrun with plans of instruction dominated by a single device, arrangement, or method. This exploita-

tion of some one phase of teaching technique, to the consequent neglect of others that should have been combined with it, accounts for the more or less faddistic tone which has accompanied programs for reform in the teaching of handwriting. A new writing system has usually meant an attempt to find a new specific for all the ills of illegible and ungraceful penmanship, rather than a wide survey and appraisal of all the means at command. In such circumstances, it was natural that the rank and file of teachers should feel a wholesome suspicion of the constant attempts at radical change. They became conservative, and have remained more conservative in this subject than in any other. Accruing systems of instruction have not interested teachers as much as they should, considering that, however extreme and one-sided these plans may be, they usually represent successful experience in a particular direction. Out of this lethargy the mass of teachers must be roused.

It will not be difficult to interest classroom teachers in the improvement of their methods of teaching pupils to write, provided they be offered a program of constructive suggestions which is known to rest on accurate, scientific investigation. The fact that teachers are conservative in

their attitude toward change in the teaching of penmanship does not imply that they are satisfied with their own accomplishments. Penmanship offers one of the most tangible checks upon the efficiency of teaching, and teachers are not blind to the desirability of a good output. They will manifest a renewed interest in the problem the moment they feel that the discussion is sound.

It is with unusual confidence that this volume on the psychology, physiology, hygiene, and pedagogy of handwriting is offered to the teaching profession. It will interest every person who is in any way concerned with the teaching of the subject, because it presents a far-reaching and thorough analysis of the problem and its various elements. Moreover, it will aid thousands of groping teachers in diagnosing the defects of their children's achievements, in suggesting the appropriate methods for inducing improvement, and in giving some accurate objective standards for the measurement of individual and class progress. It represents just what the profession has long required, — a treatment so scientific that it commands respect, and so simply stated that it can be readily used.

THE TEACHING OF HANDWRITING

I

THE NATURE OF THE PROBLEM

Handwriting a new form of expression

LEARNING to write consists primarily in the acquirement of a new form of expression. Because of the prominence of the technical problems connected with the development of the writing movement we must not lose sight of the fact that the movement is not an end in itself, but is merely a means of expression. The child may be able to form the letters fluently and legibly and yet the writing may be deficient because it has not become subordinated to his thought processes. Writing has not been thoroughly learned until the child can give his attention chiefly to the train of thought he is engaged in expressing while the mechanics of the production of the letters are relegated to the realm of habit.

The teaching problem centers in the writing movement

While keeping the fact in mind that writing is not merely a movement by which certain marks are made on paper, it remains true that the practical problems of teaching center largely in the development of such a movement. To be able to guide the child in the most economical and efficient development of the writing movement demands an understanding of its nature and the conditions of its growth. It is well to appreciate clearly, in the first place, that writing is not an instinctive form of expression. In this it differs from speech. The child instinctively practices and gains control over the syllables which will later be combined to form the words of his native language. Children in fact have been known to develop a crude language of their own even when there is a fully developed language at hand to imitate. But no such instinctive tendency underlies the writing habit, the instinctive activities which are most nearly related to it being the grasping reflex and the indefinite tendency to handle objects. On the contrary the various simpler movements which are combined to form the complex writing movement are wrought into

a harmonious coördination only after a large amount of intelligently directed drill. The perfection of the speech activities requires practice also, but the practice in this case merely serves to render an instinctive adjustment more accurate, while in the case of writing the adjustment is not only perfected but is created through practice.

An artificial product of training rather than an instinctive activity

The importance of the teacher's part and the character of the teacher's equipment for his task are determined by this fact that writing is so largely an artificial product of training rather than an instinctive activity. The teacher should know clearly not merely what kind of written characters he wishes the child to produce, but also the constitution of the movement by which they are to be made. The correct movement will not develop itself automatically in the effort to make lines or letters of a certain sort. The same line may be made by a movement which is easy and fluent or by one that is difficult and slow. In order that the teacher may choose intelligently between the different possible ways of writing he should not merely follow rules of thumb, but

should know something of the way in which the various sensations, images, ideas and movements are associated in writing.

It is particularly important to know, furthermore, not merely how these factors are associated in adult writing, but also how they become associated in the development of the child. We need to know the changes which take place from one period of the child's life to another, and how they may be affected by training. The mistake is often made of merely determining upon the best form of writing for adults, and of failing to take account of the modifications which are necessary to be made in adapting the aims and methods of teaching to children of various ages. The development of writing in the child is governed not only by the general laws of habit formation as applied to this particular process, but also by the laws of the development of motor capacity in the child.

Psychology, physiology, and hygiene involved

The concern of the teacher is not confined to the hand movements and the expression of meanings by them. Writing also involves adjustments of other parts of the body. The eyes are employed in following the stroke as it forms the

letters and words, in order that they may be compared with a standard which is actually before the writer or is held in the imagination. These adjustments of the eyes, besides throwing light upon the process of the recognition, which is a necessary part of writing, raise problems in the hygiene of the writing process. Indeed, the opinion which was held regarding the effect of different styles of writing on the eye movements and adjustments, and the effect of these movements and adjustments on the eye and its functions, has led to radical modifications in the manner of writing and the style of the letters which are used. The same significance attaches to the posture which the child assumes in writing. Considerations of hygiene also have bearing on the character of the materials which the child uses, and the amount of light which falls upon the paper, together with the direction from which it comes.

The grasp of the general principles of the psychology, physiology, and hygiene of writing, which have been shown to be an important part of the teacher's equipment, lays the foundation for a detailed and more extensive consideration of the practical problems of instruction. There are certain issues about which controversies have

waged. In these controversies sometimes one and sometimes the other party has prevailed. But the issues have not been permanently settled because the decisions have not been made on the basis of a thoroughgoing understanding of the fundamental principles which underlie the solution. Furthermore, the experience gained in the trial of alternative methods, by which the answer to many questions of detail of method must be reached, has not been made available through a standardization of the conditions of the trial and the keeping of an accurate record of the results. At the present time much light can be thrown on the ancient controversies by bringing to bear upon them our knowledge of the fundamental make-up of the writing process, while much remains to be done in the determination of details of procedure through scientific tests.

In order to make the teaching of any subject as efficient as possible, we must know not merely the mental development which is involved in learning the subject and the methods of teaching which are the best, but we should also know definitely what results should be attained and how these results may be measured. We may thus set before ourselves and our pupils definite aims and standards of attainment. Such aims and

standards not only furnish a criterion by which we may decide whether progress is being made, but they also serve as spurs or motives to progress. Accordingly the last chapter contains an analysis of the qualities according to which writing may be judged to be good or bad and a standard of attainment which is proposed for the pupils of the various grades of the elementary school.

The aim of the following pages is to treat the problems which have been outlined in such a way as to be of service to the teacher who is confronted with the practical situation in the schoolroom.

II

THE CONSTITUTION AND DEVELOPMENT OF THE WRITING PROCESS

The writing act is complex

When an educated adult writes a letter the process appears to be a perfectly easy and natural one. The connection between the words which express the ideas in his mind and the hand movements by which the words are written seems to be a direct and matter-of-course connection. In the same way all actions in which we have attained proficiency appear simple. But this simplicity is something which has been achieved through a long course of practice. The outward act remains as complex as ever, but the actor has ceased to pay attention to all of its details, as we shall see more particularly.

In order to convince ourselves of the fact that the complexity of the writing movement is reflected much more completely in the mind of the child than in our own, we have only to regard our experience in an activity in which we are relatively unskilled. We can reproduce in a measure

in our own experience the condition under which the child writes by endeavoring to trace an outline which is seen in a mirror. Under these conditions the pencil goes off in all sorts of unexpected directions, and the attention is drawn to each separate adjustment which it is necessary to make in order to bring the pencil back from its erratic course, and to the movements of the hand and fingers by which these adjustments are made. A still closer analogy exists between the child's writing and the attempts of an adult to write with the toes. This is not at all a fantastic illustration. Anybody can learn to write with the toes who will expend the same amount of time and effort which the child expends in learning to write with his fingers. A little experimentation with some such unusual kind of writing will be more efficacious than a large amount of mere discussion in making one realize that the writing habit is not instinctive, that it must be developed gradually and by much practice, and that it is very complex.

The movement is composed of a variety of elementary movements

If we consider merely the muscles and joints which are involved in the writing movement we gain some notion of its complexity. Professor

Judd[1] has furnished us with a method of distinguishing some of the elementary movements in writing by the use of his "hand tracer," shown in Fig. 1. This instrument is fastened by a spring about the hand at the base of the little finger, and records the movements of the hand and arm. In some experiments which were made with this instrument it was found that in the writing of most individuals both the arm and fingers play an essential part in the writing movement. This is made evident by Fig. 2, which is copied from Professor Judd's report. Whether or not it is best to move the fingers as well as the arm in writing is a question to be discussed more fully in the chapter on pedagogy, but the fact that most persons write in this way is significant. Some persons write with more and some with less finger movement, but only a very few, who have had special training beyond that

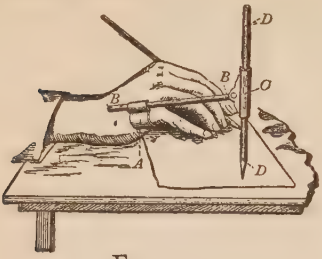

FIGURE 1

Reproduced from *Genetic Psychology for Teachers*, by Charles Hubbard Judd. Copyright, 1903, by D. Appleton and Company.

[1] C. H. Judd, *Genetic Psychology for Teachers*, chap. VI.

which is given in the ordinary school course, are able to exclude finger movements entirely.

In the case of the majority of persons, then,

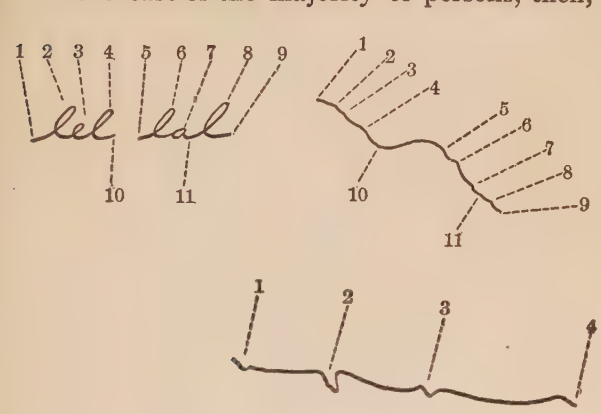

FIGURE 2

Reproduced from *Genetic Psychology for Teachers*, by Charles Hubbard Judd. Copyright, 1903, by D. Appleton and Company.

there is division of labor between the arm and the fingers. One function of the arm is clearly to carry the hand along the line from the left to the right side of the paper. This may be done either by swinging the forearm about on a pivot formed

by the elbow or by the muscle pad just below the elbow, or by lifting the forearm and shifting it along. When the desk is low, these sideward movements are made chiefly at the shoulder joint, and therefore by muscles at the shoulder. When the desk is high so that the elbow is held some distance from the body, they are due in considerable measure to rotation at the elbow. It is evident that as compared with shifting the position of the elbow the rotation of the forearm about a pivot is the more economical, since in this latter movement time is not taken to interrupt the movement by lifting the arm. If this is true it has a bearing on the relation between the position of the paper and that of the arm. The best relation is one in which the forearm is at right angles to the line of writing.

If we assume that the arm carries the hand along the line while the fingers form the letters, the finger and arm movements may still work together in one of two ways. Either the one may alternate with the other or the two may go on simultaneously. The alternating relation is one frequently seen in the writing of young children, but it is by no means confined to them. One frequently sees children and older people write with the hand in a given position until the fingers become so cramped that they can progress no

further, when the arm is lifted and the hand is carried to a new position. According to the other method the hand and arm progress along the line during the formation of the letters, and it is not necessary to readjust the relation between them at frequent intervals.

In the writing movement of some persons another movement coöperates to carry the hand along the line. This is a side-to-side movement about the wrist joint. Such a movement is indicated in the tracer record when the line of the record slants downward sharply while the word or group of letters is being written, and then takes a backward and upward course in the readjustment preparatory to writing the next word. The downward slant is produced by the rotation of the wrist to right and the upward slant by its return to the original position at the beginning of the word.

The arm not only carries the hand along the line, but also, in the arm-movement writing, has a share in the formation of the letters. The movement of the arm in this case is made chiefly by a rotation in the ball and socket joint at the shoulder, and is produced by the shoulder muscles. The terms which are sometimes used to describe this type of movement convey a false impression. Both the terms "forearm movement" and "mus-

cular movement" make it appear that the movement is produced by muscles in the forearm, but a little examination will show that, in the arm movement, these muscles merely serve as a passive rest for the arm, and that they are active only in producing movements of the wrist and fingers.

It is clear, if we examine the work of the fingers, that there is division of labor among them also. The pen is not grasped by all the fingers, but by the first two fingers and the thumb. This is not the way the child naturally grasps it. The earliest and most fundamental method of grasping such an object is to fold the fingers about it without using the thumb. The infant and the monkey grasp in this way. The next most natural method is to bring the tips of all the fingers together in opposition to the thumb. Monkeys and young infants never handle things in this way. To bring two of the fingers in opposition to the thumb and to use the others to support the hand is a still more difficult and complex thing to do. It has been found by experiment that young children do not readily move one finger in isolation from the others, as, for example, in striking successively the notes of a piano. They tend rather to tap with all at once.

The use of a pen or pencil in the ordinary way is difficult, then, because it involves separating

the action of some of the fingers from that of the others and because it involves the united action of these fingers and the thumb. This conclusion is supported also by the anatomy of the muscle and nerve groups which govern the movements of the fingers and thumb. The chief muscles which move the fingers and thumb are located in the forearm — not in the fingers as is often assumed. The nerve cells which control the fingers form a group which are naturally associated in their action, and the nerve cells which control the thumb form another group. This fact explains why the coördination between fingers and thumb is so difficult.

Whether or not the letters are formed by the movements of the fingers, then, they have a distinct function to perform since two of them have the office of supporting the hand while the other two, with the thumb, grasp the pen. When these latter also contribute a large share toward the formation of the letters, the adjustment of the movements to one another becomes delicate and complicated. The matter has been studied by an Italian investigator, Obici,[1] who invented

[1] G. Obici, Ricerche sulla Fisiolgia della Scrittura. Rivista sperimentale di frenitica e medicina legale della alienazioni mentale. 1897, 23, 623 and 870.

an instrument which he calls a "graphograph." The device consists in a pen to which are attached three levers against which the thumb and first two fingers press. The pressure which they exert is transmitted pneumatically to delicately adjusted pointers. By means of this instrument we can measure exactly the actions of the fingers which are presented to ordinary observation less precisely.

A succession of strokes of various kinds — upward and downward, oblique and upright, curved to the right or left or straight — presents the different combinations of movements in continually changing order. Each component movement must be made at the proper time and with the proper amount of force or the stroke will be distorted. For example, a downward stroke is made mainly by the pressure of the first finger against the pen, while the thumb and second finger guide. If additional pressure is exerted by the second finger the line will deviate to the left. To produce a curve such as that of the downward stroke of the *c* there must be an excess pressure exerted first by the second finger and then by the thumb. When the stroke reaches the bottom the first finger must relinquish the chief rôle, which then passes to the thumb. If the next up-

ward stroke forms the first stroke of an *e*, for example, the middle finger first gives way and then presses against the thumb to form the loop at the top. On the other hand, if the next letter is the *m*, the second finger exerts a somewhat stronger pressure during the upward stroke and then releases it at the top. Such is the ever-shifting balance of forces by which the apparently simple writing movement proceeds. It is not to be wondered at that the child's pen runs off the track, and the precision of the adult writer is only to be ascribed to the wonderful efficiency of an act which has become a habit through long practice.

This analysis of the manner in which the component finger movements are coördinated in producing the letters furnishes the explanation of the fact that arm-movement writing always tends toward an angular style. The upward and downward movements can very well be made by the oscillation of the arm, but the complex curves which compose the letter forms are more easily produced by the fingers.

The movements which have been described are sufficient to produce a succession of letters and words. An additional movement is often employed, however, as a corrective. As the hand

moves across the page with the elbow as center of rotation, the direction in which the fingers point is constantly changing. At the right end of the line they point much more toward the right than at the left end. The effect of this is to make the letters slant more toward the right as the hand progresses along the line. This error may be compensated for in more than one way, but, as Professor Judd has pointed out, some writers make the correction by means of an additional movement. It may be easily determined by the reader for himself that if a series of strokes are made with the hand turned over toward the right side and then another series are made with the hand turned with the palm down, the second series is more nearly vertical then the first. This turning of the hand toward the left so that the palm faces downward is called pronation, and it will be readily seen that it is suited to correct the overslant of the letters at the right at the end of the line.

We have completed the list of the movements which combine directly to form the writing coordination, but it is evident, on a moment's consideration, that we have not exhausted the list of bodily adjustments which are necessary to the activity. The body is held erect to furnish

support to the arm. The left hand holds the paper and moves it from time to time and the left arm steadies and supports the body. Finally, the eyes and head are adjusted to the perception of the characters which are being formed. We shall see that many important practical questions are concerned with the maintenance of a healthful posture and the avoidance of eye-strain.

The fact that the eyes are adjusted to the perception of what is being written calls attention to the fact that there are other elements in writing beside the mere muscular movements. These are the sensations and perceptions which serve as a guide and standard for the movement.

Writing also involves control sensations and language ideas

The guidance or control of the writing movement by vision is particularly prominent in the early stages of learning. The adult can write blindfolded nearly as well as with his eyes open. The only features of the writing which suffer noticeably are the size, spacing, and alinement. The child, however, is largely dependent upon his sense of sight for the correct formation of the letters as well as for the control of the writing in

regard to these more general aspects. In the adult the immediate control of the details of the activity has been largely assumed by the sensations of movement and the pressure sensations. The importance of these latter may be very well demonstrated by writing with a pen which is so constructed that the pressure of the pen against the paper is not perceptible. Under such conditions the writing suffers not only in alinement and spacing, but also in the formation of the letters. This is particularly true when the eyes are closed. When the eyes are open the adult writer can in a measure compensate for the loss of the sensations of pressure by making a closer inspection than usual of the movement of the pen.

We may conceive of the pressure and movement sensations in writing as being not yet organized in the experience of the young child. That is, he does not yet know with any assurance how it feels to write a certain letter or word, but must rely upon his eye to inform him whether or not he is doing as he intends. As he writes more, these sensations become organized. Certain of them, following each other in certain order, come to represent particular letters or words. This seems always to occur when writing becomes fluent

and easy. The practical application of this fact is that the child must write a great deal and at a sufficient speed for the successive sensations of movement and pressure to become associated with one another, and with the visual forms which they represent.

But writing is not merely the production on paper of certain forms. These forms have a meaning, and writing is for the purpose of expressing this meaning. In writing, as in reading, one says over more or less completely to himself the words which are being written, and the word images are the symbols of ideas. The writer starts out with an idea which he wishes to express. This idea is represented by groups of words imaged more or less clearly as heard or spoken, or both. These word images then call into being the appropriate writing movements.

How the mental process becomes simplified through practice

In the manner of the connection between the idea and the movements of writing, there are important changes in the course of development. As has been said, to the practiced writer the writing movement seems to follow perfectly naturally upon the idea to be expressed, but in

the experience of the child there is a chain of intermediate processes. One may get some idea of the process through which the child must go by examining his own experience in using a typewriter. Even if one is proficient in the use of this machine, the learning process is recent enough so that it can probably be recalled. Starting with the idea, one in the early stages of practice has to form definitely in his mind the words which express the idea. The phraseology is thought out more clearly in advance than in the more familiar processes of speaking or writing. The case is like that of a person who learns a foreign language as an adult, but who, instead of putting his thought directly into the foreign words, thinks them in his own tongue and then translates.

The next step after clearly formulating our ideas in words is to spell the words out. One does not realize how automatic the process of spelling becomes in ordinary handwriting until he tries to write by the less familiar process. He has to think out the sequence of the letters as seen on the printed page, or as pronounced orally, and then follow this sequence in the letters on the keyboard. Then each movement which must be made in order to write the successive letters must

be thought and made separately. Finally, after the movement is made, it is given a parting thought to make sure it was the one which was intended.

It is not surprising that by the time these processes have been gone through, the thought connection has been lost. So it must be with the child who is in the early stages of learning to write. He must go through the same stages of anticipating the words he is to write, the spelling of these words, and something of the details of the form of the letters and of the position of the hand, the movements, etc., by which the letters are produced. Hence the well-known fact that young children cannot express their thoughts fluently by writing. The mechanics of the writing process stand in the forefront of the attention and interrupt the flow of thought. As practice proceeds, these steps follow one another more rapidly and more closely so that they interrupt the thought process less. The writing process becomes more nearly automatic — that is, it becomes capable of being carried on without the direction of attention. The attention can then be occupied more fully with the meaning which is to be expressed.

There is a certain time when the child must be

thinking chiefly of the formation of the letters and the mechanics of the process, but this stage in learning may be prolonged beyond the time when it is necessary or desirable. A person may have the mechanics of writing highly developed, but not be able to use it efficiently in the expression of his thought. It sometimes occurs that a person can write very excellently when it is purely a formal matter, but uses an inferior "hand" when he is writing a letter. On the other hand, it sometimes happens that a person with a halting, uncertain movement develops fluency and ease when he grows accustomed to the use of writing to express his thoughts.

The opposite danger of releasing attention too early from the mechanics of writing or the details of form is also present. Generally speaking, improvements in the character of the movement or the form of the letters cease when one no longer exercises a critical supervision over the process. Mere practice does not bring improvement. The pupil should early begin to use writing as a means of expression of meaning, but there should also be practice periods when the attention is directed to the improvement of the habit until the habit has reached the degree of perfection which is thought desirable.

The movement becomes organized with practice

From the point of view of the thought or meaning side of writing then, we have found that writing becomes increasingly automatic with practice. The attention is freed from the details of the movement. From the point of view of the movement, this process consists in a more thorough organization of the elements of the coordination. In the first place, excess movements become eliminated. When the child begins to write, the nervous energy is diffused throughout a large part of the body. The face is contorted, the feet are twisted about, the left hand is tightly clasped, and the body is bent. The same phenomenon may be observed in the learning of the adult, as, for example, when in learning to ride a bicycle he grips the handlebar with unnecessary force. Out of the excess supply of movements, the child must learn to use only such as produce the desired movements of the pen.

The elimination of useless movements, or the selection of appropriate ones, is one of the fundamental processes in motor learning. A practical question which may be raised concerning it is whether the result can best be reached by emphasizing the movements which are to be selected or

those which are to be eliminated. In general, it is much better to fix attention on the movements which are to be made, and allow the superfluous movements to drop out of themselves. It is a familiar fact that the bicycle rider avoids the ditch best by keeping his attention on the path. The nervous energy is automatically withdrawn from the channels leading to the muscles not concerned when the nervous channels to the appropriate muscles become more open. Directions should be positive, then, rather than negative. The pupil should be shown what to do rather than what not to do. The only exception to this rule appears when the pupil has fallen into bad habits which need to be broken up. Then it may be necessary to call attention to the thing to be avoided.

The appropriate movements become selected from among the great number of superfluous movements as they become organized into modes of action which produce the desired result. The nervous energy is at first widely diffused because the nerve cells which control the groups of muscles which are associated successively and simultaneously in the writing movement have not become so connected that the nervous energy finds free outlet through them. The organization of

these nerve centers can proceed only through practice — that is, through trying to make the movement which will produce the forms set before the child as a model. There is no royal road to this end. The child must learn by the slow method of trial and success. He knows roughly what form he desires to make, but does not know how to go about it to make it, except in a general way. He has no recourse but to make the attempt. He succeeds partly because he has learned to make movements somewhat similar in the past, but his success is not complete. He now tries to improve on his first attempt. If he fails, he tries again. If he succeeds, he may be able to repeat his performance. But he is not able to anticipate the method by which success is reached. He can only retain the measure of success he has attained by blind trial until further trials bring him nearer his goal. Practice or drill, therefore, is the only means of learning to write. The essentials of good drill will be discussed in the chapter on pedagogy.

As the movement becomes organized the attention comes to comprehend larger units

When the child first essays to write the letters which are before him (and which compose the

words which he uses in his spoken language), his attention is absorbed, as we have seen, in reproducing the forms. In striving to copy the forms of the letters, he keeps their appearance in mind as well as he can and watches the letter which he is making in order to see when it deviates from the model and to bring back the stroke when it goes astray. He follows the stroke bit by bit with the eye, and it is his eye which seems mainly to "control" the stroke. After he has made the various letters over and over he gradually learns how it feels to make them, as has already been said, and he finds it no longer necessary to follow the stroke minutely.

Now is the time when the child can hold in mind several strokes or letters at a time. He can safely assume that the motor habit under the control of the sensations of movement and pressure will execute the details of the letters. As the child thus holds in mind several letters or a word at a time, it comes about that the individual strokes are subordinated to the more general features of the writing. Thus he can pay more attention to the uniformity in size, slant, etc., of the letters. It may be seen, by comparing the writing of children with that of adults, that children commonly form the letters more carefully,

but that the writing as a whole is more uneven or ragged.

Another result of this broadening of the scope of the attention concerns the movement. The movement becomes more uniform, or, in other words, it acquires greater rhythm. The successive strokes tend to be made at equal intervals of time as though to music. This undoubtedly explains much of the deviation from correct form in the writing of adults. Parts of letters which would take more time if made correctly are hurried over to avoid breaking the regular beat of the strokes. At the same time, rhythmic movement has a great advantage on the score of ease and rapidity. We shall consider its practical importance again in the chapter on pedagogy.

Learning to write is conditioned partly by the stages of development at different ages

We have been considering those features of the formation of the writing habit which are inherent in the learning process itself and which are the same whatever the age or the degree of maturity of the learner. Certain questions regarding the time and manner of teaching writing, however, require for their solution a knowledge of the capacity of the child at different ages for complex

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and delicately adjusted movement. Systems of teaching which are found to be suitable to youths or adults in business colleges are often applied without sufficient modification to children in the primary grades. Such procedure results in a waste of energy and effort.

The child's ability to make precise, complex, and rapid movements increases continuously from the first year at least to youth. For practical purposes, however, certain division points may be designated which mark changes in the child's attitude toward his movements and an increase in capacity more rapid than at other times. One such point is of particular significance for the teaching of writing because it falls within the period of the grades.

Students of the child from different points of view have independently fixed on the age of nine or thereabouts as a time when the child becomes willing and able to apply to his movements some outward standard. In his play, for example, the child now sets an aim to his movements. Before this, they were free, and enjoyed merely for themselves; or they were dramatic or symbolic in character. Now, the child not only runs because he enjoys the experience or pretends that he is an Indian or what not, but he runs to excel some-

body else or even to make a record. So also in drawing he ceases to make merely rough sketches which represent but do not resemble objects, and makes an effort to portray more accurately their form and spatial relations. A brief study made by the author indicates also that the facility of movement in making simple upward and downward strokes with a pencil increases more rapidly at this time than during the rest of the child's school life.

The methods and aims of training should take account of these facts and require more of the child in the intermediate than in the primary grades. A system which sets the same standard of speed or accuracy before children in the different stages is fundamentally wrong. The application of this principle, and of the others which have been set forth in this chapter, is a matter to be discussed more particularly in the following pages.

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III

THE PHYSIOLOGY AND HYGIENE OF WRITING

In the preceding chapter we saw that one does not write with the arm alone. The body furnishes a base or support for the arm, the left hand is often engaged in holding the paper, the eyes rotate and the lenses of the eyes are focused upon the page. These facts are of particular significance because, first, the position of the body may be such as to distort the skeleton, particularly the spine, causing a permanent deviation from the normal adjustment; and, second, the way in which the eyes have to be adjusted in certain positions of the paper or kinds of writing is regarded by many as injurious to the sight. We shall at once consider the requirements of posture and then the requirements of the hygiene of vision.

The requirements of good posture and their consequences for writing

The requirements of good posture can be put in a few words. The deviations from good pos-

ture and the causes of these deviations are somewhat more complex. We shall take up the important features of good posture, discussing first the positive requirements, then the kinds of deviation which appear when the child writes, and finally the conditions of writing — the position of paper, slant of writing, etc. — which affect posture favorably or unfavorably.

Before entering upon this discussion, a word should be said to prevent a too rigid application of the principles of posture. Perhaps the danger is rather in the opposite direction, but it is well to know that when we allow what seems to be occasional lapses from what is ideally best, we are not compromising with our principles, but are applying another equally valid principle. This principle is that it is not ideal for the child to maintain any position whatever, except one of relaxation, for a considerable length of time. We must allow and encourage frequent changes of position, and the younger the child the more frequent the changes must be.

The danger to avoid is that the child shall deviate habitually in one particular direction. This causes maladjustment of the bones, or compression of some of the organs, or both. But it is perfectly natural for the child at one moment to

take a position which deviates in one direction from what may be considered abstractly the normal or ideal, and at the next moment the position which deviates in the other direction. We may define and use the ideal or normal, then, as the posture about which the child may deviate in several directions, but from which he should not deviate permanently in any direction.

The first requirement of good posture is that the body and head be held erect. This rule has reference to the forward and backward bending of head or body. With reference to the body, it means first that the back shall not be rounded out, thus compressing the lungs, stomach, etc., and causing the protrusion of the abdominal wall. The result of this position is restriction of the depth of breathing, interference with the process of digestion, congestion of blood in the abdomen, and a lowering of the tone of the muscles of the abdominal wall.

A second defect consists in leaning either forward or backward — usually forward — so that the center of gravity of the body lies outside the base formed by the pelvis. In such a posture the position of the body must be maintained by continual and unnecessary muscular tension —

a waste of nervous energy. These two defects may exist in combination.

These defects of posture may be avoided in large measure by requiring the child to sit well back in the chair, by seeing that the feet rest flat on the floor, by having the seat at such a height that the feet rest on the floor and the thighs are level, and by having the seat project about three inches under the desk. These requirements are generally recognized. Another requirement is equally important, which is that the desk top should slant toward the writer. This requirement affects the position of the head as well as that of the body. When the paper on which one is writing lies horizontally, there is a very strong impulse to bend the head and body forward in order to prevent the unpleasant strain resulting from turning the eyes down in their sockets through a considerable angle. It may also be that the impulse is due to the unrecognized motive of seeking to look at the paper perpendicularly rather than at an angle. That the impulse to bend forward is present is indisputable, and that it is lessened by tilting the desk forward fifteen degrees or more is a fact of observation.

The fault of bending the head forward and the remedy have been mentioned. Some forward

bending is, of course, necessary. No exact rule can be laid down as to how much can be allowed with impunity. Perhaps we may say that the danger line is reached when the head is bent through an angle of forty-five degrees from the perpendicular. Extreme bending of the neck restricts the circulation and causes congestion of blood in the eyes.

The other chief defects of posture consist in bending the head or body to one side or the other, or in turning the head or body in either direction.

Bending or turning the trunk, which causes curvature of the spine, may be largely avoided by requiring the pupil to face the desk squarely, and to rest both forearms just below the elbow on the desk at an equal distance from the body. This implies that the paper be placed directly before the pupil on the desk, and not to the right of the middle line, as has often been done.

The remaining defect of posture consists in turning or bending the head. The danger is, of course, again that curvature of the spine will result from a constant holding of the head in any but an erect position. All the possible forms of deviation from the ideal position of the head may be found, but we are concerned chiefly with

the effect of the position of the paper and the slant of the writing upon the head position.

On the bearing of the position of the paper and of the slant of the writing on the position of the head, there has been a great deal of controversy. It has been held on the one hand, that any position of the paper except one in which the line of writing is parallel to the edge of the desk, and any deviation of the letters from the vertical, cause bending and twisting of the head and even of the body. Those who uphold this view believe that there is a strong tendency to bring the head into such a position that the line connecting the two eyes is parallel to the line of writing, so that as one looks along the line the eyes move merely in a horizontal and not in an oblique direction. This assumption is based on the so-called Wundt-Lamansky law that the eyes move most freely in a horizontal or vertical direction and less readily in an oblique direction.

Measurements made by other investigators, however, indicate that when the line of writing is tilted, the eyes are not as a matter of fact brought into such a position that the line joining them is parallel to the line of writing, but that this line tends to be perpendicular to the main downward strokes of the letters. This is ex-

plained as due to a tendency to sight along the main strokes of the letters. The movement of the hand along the line in writing and the consequent horizontal movement of the eyes are so slow that it is a question whether the Wundt-Lamansky law applies in this case. Whether it is due to the tendency to sight along the main strokes of the letters or not, it is a fact noted by a number of investigators that the main strokes of the letters take a direction which is approximately perpendicular to the edge of the desk when the writer faces it directly. This fact will be referred to in the discussion of slant.

While the theoretical discussions of the matter, then, are not entirely conclusive, it is clear that the evidence is as much against as for the argument for a straight front position of the paper and vertical writing when that argument implies that any other position or kind of writing necessarily causes an unhygienic posture. The measurement of the degree of deviation from good posture among children who write vertically and those who write with a slant presents, if we accept the figures at their face value, rather stronger evidence in favor of vertical writing and the position of the paper in which the lower edge is parallel to the edge of the desk. One investiga-

tor,[1] for example, found spinal curvature among 2.1 per cent of 1630 vertical writers and 3.1 per cent of 1436 who wrote with a slant.

A number of considerations are to be kept in mind interpreting these figures. In the first place the teachers of vertical writing undoubtedly paid more attention to the posture of their pupils than did the others, since vertical writing was introduced with the purpose of improving posture clearly in mind. In spite of this fact, two investigators reported finding classes of vertical writers whose posture was very poor, and classes of slant writers with entirely correct posture. Furthermore the slant which was used by these pupils was presumably that used commonly at that time and place — about 1890 in Germany. In the figures given by one investigator, the average angle of the writing in two classes was forty-three and fifty-seven degrees respectively, while the average for a third class was between these two. Such a degree of slant would now be considered excessive, at least in American schools, and would rarely be found.

If we allow for the difference in the attention paid to posture of the pupils, then, and for the dif-

[1] Cited in L. Burgerstein and A. Netolitzky, *Handbuch der Schulhygiene*, Jena, 1895, G. Fischer, p. 273.

ference in the amount of slant of the writing, the significance in these figures becomes small. Furthermore, when the measurements for the different school grades are taken separately, it appears that the greatest difference in posture between those who write vertically and those who write with a slant existed in the first and second grades. It is precisely in these grades that the advantage of a slant is least. In the first two or three grades, then, considerations of posture have some bearing upon the kind of writing to be taught, but in the other grades it is of very slight importance. A slight degree of slant does not have sufficient influence upon position to counterbalance other reasons for a slant. What these reasons are we shall see in the next chapter.

We have been considering posture from the standpoint of hygiene. It may not be out of place to remark here that good posture is of importance also for its influence on the writing. When the body is held erect, it forms a firm support for the arm and at the same time allows the arm greater freedom of movement than when the body slouches. This is sufficiently evident.

Good posture is a habit and one which needs to be built up by constant drill. All the evidence points to the fact that, while the proper arrange-

ment of the seat and desk, and the position of the paper on the desk make a good posture easier, they do not, of themselves, insure it. If bad habits are once formed in this respect, it is difficult to break them, but a little attention to the matter in the earlier grades will suffice to form right habits. A necessary precaution is to avoid undue fatigue or restlessness by not requiring the young child to hold the same posture too long. For details regarding seats and desks, the reader is referred to any good book on school hygiene.

Requirements of hygiene of the eyes

Besides posture, the teacher of writing is concerned with the eyes and their hygiene. It has been asserted that improper conditions of writing cause eye troubles, particularly myopia or short-sightedness.

Several requirements for the avoidance of injury to the eyes by writing may be made. In the first place, the two eyes should be at the same distance from the point to which they are directed. This is sometimes not the case when the paper is placed to one side. For example, if the paper is on the right of a middle line and the head faces directly forward, the writing is nearer to the right eye than to the left. This condition is often

avoided unconsciously by the writer by turning and bending the head to the right. This, of course, introduces another faulty condition. The remedy is to place the paper approximately in front of the writer. The left end of the line may then be a little to the left of the middle and the right end to the right. In this case the head may turn a little to the left at the beginning of the line and to the right side toward the end. It is only when the position taken is preponderantly on one side or the other of the straight position that there is danger.

The reason that harm results from the unequal distance of the writing from the two eyes is that it causes nervous strain. The nerve centers which control the adjustment of the two eyes are so intimately connected that the eyes instinctively converge and focus upon the same point. If an object which is close at hand is nearer to one eye than to the other, that eye must have a shorter focus. For distant vision this difference is so slight as to be negligible, but for reading or writing it is important. Considerable strain is put upon the eyes in any case to keep them focused upon objects within eighteen inches, and when conditions require that the eyes be focused upon points unequally distant, the strain is increased.

The second requirement is that the strain incident to constant near vision be minimized by not allowing the eyes to be held too near the paper. The distance will be limited, of course, by the size of the child, the height of the desk, etc. If the child is sitting erect, if the desk is at such a height that the elbow is about three inches from the body, and if the right forearm rests with most of its length upon the desk at an angle of about sixty degrees with the edge, the eyes will be as far from the writing as good writing conditions permit. In the adult the distance under these conditions is about sixteen to twenty inches. For the child the following distances may be taken as a minimum for the grades designated: primary, ten inches; intermediate, twelve inches; grammar, fourteen inches. Of course it would be desirable to keep the writing at still greater distance from the eyes, but the size of the child places limits upon the distances which are practicable. Those which are given as standards imply that the child sits erect.

Certain conditions produce a tendency for the child not to sit erect, but to lean forward and to bring the eyes closer to the paper. One of these conditions, which has already been referred to in discussing posture, is the slope of the desk. A desk

top which is tilted through an angle of at least fifteen degrees is an important aid to the maintenance of good posture, at least in the primary grades. It is important also that the writing be large enough for the child to see easily at the required distance. A safe rule is to require that the one-space letters be an eighth of an inch in height. For the primary grades, the requirements of the movements make necessary larger letters. We are here considering only the requirements of vision.

Some investigators have found that 2.1 per cent more of those who write with a slant are short-sighted than of those who write vertically and that the former hold the eyes from one to two inches closer to the paper than do the latter. The remarks which were made on similar results in discussing posture apply here also. We do not know what the other conditions of the writing were. Presumably the teachers of vertical writing exercised more care about posture than did the others. We do know that the slant was excessive, and that in many cases, at least, the paper was placed considerably to the right of the middle position. Good hygienic conditions for the eye can be secured without resorting to vertical writing.

The character of the surface of the paper, the sort of mark which is made by the pen or pencil, and the arrangement of the lighting also affect the amount of eye-strain incident to writing. The paper should not have a glazed surface — that is, should not reflect enough light to present a shiny appearance. If a pencil is used, the paper should be rough enough to take a good mark. The pen or pencil mark should offer sufficient contrast to the paper to be easily seen. The light should come from above or from the left and should be diffused daylight.

The hygiene of movement

Besides maintaining correct posture and avoiding conditions which produce eye-strain, the teacher of handwriting must consider the possibility of a nervous strain resulting from the hand movement and its conditions. A movement which is not suited to the child may cause an undue expenditure of nervous energy in the same way as improper conditions may cause eye-strain and consequently undue expenditure of nervous energy.

We may begin with the general question: What sort of movement is suited to the young child, or what changes in the type of movement

take place with the growth and development of the child? An answer to these questions which has been widely accepted, and which has had a distinct effect upon practice, is expressed in the doctrine of fundamental and accessory movements. This doctrine has been invoked as an argument against certain of the kindergarten occupations, such as threading beads and sewing or any use of the hands in fine work. The child should, it is urged, use the large free movements and the muscles of the trunk and defer the finer hand movements until some time after he enters school. Obviously this doctrine has a bearing on writing and must be examined more closely.

If we seek to determine by a study of the writings on the subject just what is the distinction between fundamental and accessory movements, we meet with a diversity of interpretations. One common assumption seems to be, however, that fundamental movements are those which are old in the history of the race — such, for example, as walking; while accessory movements are those which have been acquired in more recent stages of evolution. We may assume that the older movements are, to some extent at least, instinctive, while the adjustments more recently acquired have not an instinctive character, but

must be learned by each individual. If this is the interpretation to be made, it is obvious that fundamental (instinctive) movements are easier for the child to make. But this does not solve the problem, for it is obvious that our task is not merely to allow instinctive movements to develop, but to teach the child movements which are not instinctive; for example, handwriting. What we wish to know, then, is whether there is any principle which governs the order in which new combinations of movements may be taught the child.

Our doctrine meets this problem by the further assumptions, first, that fundamental movements are movements of large muscles, or large movements, while accessory movements are movements of small muscles, or small movements; and second, that fundamental movements are central, that is, of the trunk or toward the trunk, while accessory movements are peripheral, that is, toward the extremities. The conclusion from these assumptions would be that the child should make only or mainly movements of the large muscles (or larger movements) and central movements.

Interpreting "fundamental" in these senses we may examine the validity of the theory by

inquiring whether the child's instinctive movements are wholly or chiefly fundamental, or whether his spontaneous movements are at first fundamental and become only gradually accessory with his increasing age.

A study of the matter will serve to show that many of the child's early instinctive movements employ neither the large nor the central muscles. The earliest clearly instinctive movement is sucking, which involves both small and peripheral muscles. Another early reflex is the clasping of the hand about an object touching the palm. This also involves peripheral and relatively small muscles. Soon there appear instinctive movements of facial expression and the adjustment of the eyes, as in following a moving object. The movements of the trunk in sitting, standing, and walking appear later than all of these.

The same is true of the child's spontaneous movements, which are of special significance in this connection because they are the material out of which the new coördinations are formed. The child certainly makes spontaneous movements of the arms and legs and vocal cords as early as those of the trunk. And in the arms and legs themselves movements of the extremities — the fingers and toes and the wrists and ankles—

are as prominent as the larger movements of the limbs. The movements are not, to be sure, coördinated; but we are not speaking of coördinated movements, for the movements of the limbs as a whole are not coördinated either. When the child begins to handle objects the very term we use to describe the act indicates the employment of the hand. If the rattle is waved to and fro by the arm, it is also grasped by the hand. When the child is excited, or is expressing an emotion for which he has no coördinated form of response, he may wave arms and legs aimlessly, but much of his time is spent in examining objects and handling them, and in this he uses the peripheral and smaller muscles. There is, then, no warrant from the child's natural development in contending that we must confine his activities to those which employ central or large muscles.[1]

Certain kinds of movements do, however, undoubtedly cause nervous strain and fatigue for the child, and care should be exercised that his

[1] The fact that there is somewhat more improvement in rapidity of movement and in steadiness, which was determined by the studies of Bryan (Amer. Jour. of Psychol. vol. v, p. 123) and Hancock (Ped. Sem. vol. III, p. 9) is not conclusive evidence of the earlier maturing of the central muscles and nerve centers. The small amount of difference may very well be accounted for by the greater practice in the peripheral adjustments.

movements be suited to his age and capacity. The development of the child's capacity for movement is not essentially different from that of the adult except that in the case of the child there is development of general capacity as well as development of ability in special forms of activity.

Since the development of the child's general capacity in movement cannot be adequately described in terms of the fundamental-accessory movement theory, we must seek to define it in other terms. Experimental evidence has clearly demonstrated that there is marked development in movement in a number of respects. The steadiness with which a child of six years can maintain any position is increased fourfold by the time he reaches the period of youth. Precision of movement is relatively deficient in the young child. In speed of movement there is an increase which is represented in tapping with the fingers by more than two a second. The ability to make a complex movement, such as tying a knot, is noticeably deficient in the young child. The redeeming feature is that the child's nervous system is very plastic so that he is capable of readily learning new forms of activity.

The precaution which is necessary to observe is that the child below the age of nine or ten be

not required to make movements which are very precise, rapid, or complex, or which require great steadiness of adjustment. The reason that peripheral movements are often injurious is not that they are peripheral, else we should have to prevent the child's using his hand, and thus gaining valuable training. The reason is rather that peripheral movements are commonly more precise than are central movements.

The reason that it is necessary to take precautions in this matter is that the adult often does not realize that a movement which for him is rough and careless is for the child precise and careful. It is easy for the adult to realize the strain of attention and fatigue due to making adjustments which are to him very precise, such as would be involved in making a fine mechanical drawing, adjusting the parts of a watch, or doing intricate embroidery. Yet the expert in these fields can work all day without undue fatigue. The feat of ordinary writing which an adult can carry on for hours is to the young child a task fatiguing both because of its newness, and because the degree of precision which is required is high in relation to his ability.

Every possible means should therefore be taken to minimize for the child the nervous

strain of writing. In the lower grades, the writing period should come at a time when the child is not already fatigued. Too great precision should not be demanded. The writing materials should be such as to lighten the task and not increase its difficulty. A pen should not be used at all to begin with. The first pen used should be coarse. The penholder should be of some material which can be easily held in position, such as cork or soft rubber, and should be of medium size. The penholder which is used by the child in the primary grades should be smaller that that used by older children. The general rule is that the holder should not be so small that it cannot easily be kept from turning in the fingers, nor so large that the fingers cannot easily be bent in a natural manner. The surface of the paper should be hard enough so that the pen does not easily stick into it.

Writer's cramp

The writing habit should be so developed not only as to meet present demands, but also, if possible, as to avoid future trouble. The same provisions are necessary to meet both requirements, but the total effects of faulty methods are not always apparent for several years. The ex-

treme condition resulting from much writing under bad conditions is writer's cramp. Bad conditions do not necessarily lead to this extreme, but the measures which have been found efficacious to prevent or cure this disease will also prove serviceable in rendering writing easier and more efficient.

Writer's cramp is a disease of the nervous system which affects writing by producing either the abnormal contraction or the paralysis of some of the muscles used in writing. In the most frequent case the muscles which flex the fingers become cramped when the individual who is suffering from the malady tries to write. The spasm not only interferes with writing, but is very painful. Advanced cases of the disease are rarely cured. A significant fact is that the malady is most frequently found among professional penmen or calligraphers. The reason seems to be that these writers make exceedingly precise and delicate strokes. Very rapid writing long continued also brings on writer's cramp.

While writer's cramp is an adult malady, it must be attacked not through curative but through preventive measures — that is, by training the child in correct habits of writing. The central point of the whole matter is that the condi-

tion which causes the trouble, and which is to be avoided, is too violent contraction of the muscles by which the pen is grasped, and by which the finger movements are made — provided the movements are made with the fingers. It is obvious to an observer of young children when they are writing that, contrary to the theory of fundamental and accessory movements, they contract too strongly the smaller muscles which control the fingers. The diffusion which appears as the child tries to make a complex and unaccustomed movement affects the lighter, more easily contracted muscles first. It becomes necessary, then, to counteract this tendency to over-use by laying emphasis upon the use of the movements of the arm. This measure of prevention and correction was recommended by European physicians when no practical form of arm movement such as is now widely practiced in American schools was known to them.

We have already seen that a rhythmical writing movement is a characteristic of mature writing, and has a beneficial effect upon the writing of children. A rhythmical, steady movement has also the advantage of being much less liable to cause cramping than a hasty, irregular one. Rhythmical movements are known to produce much

less fatigue than movements which are irregular. The various muscles operate together in a harmonious way, instead of one pulling against the other, and each one gets into the way of exerting just the required amount of force and no more.

Other means of avoiding undue cramping of the fingers have already been referred to. They concern the materials which are used in writing, the pen, penholder, and paper. It is not necessary further to dwell upon them here. All these measures have the advantage not only of preventing a remote and not very probable malady, but they also affect very beneficially the child's present writing habit.

IV

THE TEACHING OF HANDWRITING

It has already been pointed out that writing is a habit involving manual skill. This habit must be developed in the same manner as any other such habit through the application of the principles of efficient learning. The learning of any such habit is dependent upon two phases of procedure. The first of these is the adoption of correct form, and the second the acquirement of the ability to execute the movement efficiently.

Correct form in the writing movement

The adoption of correct form in the movement must not be confused with the production of good form in the letters. Correct form in movement refers to the more evident outstanding features of the movement which may readily be observed and copied. It may refer to the positions which are held before the movement starts or after it is finished. It includes those adjustments which the learner may be shown or told how to make by virtue of the fact that he already possesses a cer-

tain amount of general control over his hands and body. In writing, form refers to such matters as penholding and the position of the hand, arm, and body.

Good form is esteemed not only because it presents a better appearance than bad form, but also because it makes possible more efficient action. It represents the part of the activity in which the learner may profit by the experience of those who have learned before him. Much would be learned by each one for himself, but a good deal of any activity may be taught and not left to the learner to discover by chance. Any game of skill will furnish illustrations of this point. For example, in making a stroke in golf it is necessary, in order to insure accuracy of stroke, that the head and body be neither raised nor allowed to sway to the side. This principle may be easily grasped, and, by giving some attention to the matter, may be successfully applied.

Penholding

So in the case of writing, certain principles may be laid down governing form. First, in regard to the manner of holding the pen. Teachers of writing in the United States are coming to fairly close agreement as to what constitutes good form

in penholding. The prescriptions which follow have been reached in a purely empirical way, without the use of scientific experimentation, but in the absence of such investigation we must rely upon experience and observation to guide our practice on such points of method as these. The orthodox method of holding the pen is to grasp the holder between the thumb and the first two fingers about an inch to an inch and a half from the pen point. The pen is held mainly between the thumb and the second finger, against which it rests opposite the first joint. The first finger rests upon the top of the pen and keeps it in place, particularly in the downward movements. The holder also comes in contact with the hand at the base of the index finger. All the fingers are bent easily, each one from the middle to the little finger being bent slightly more than the one before it. The hand rests upon the two outside fingers.

The mistakes which it is most important to avoid are holding the fingers too straight so that they are inflexible or bending them too much and grasping the pen too tightly. The thumb and the index finger particularly are apt to be bent so that the middle joints form a sharp angle. This, besides leading to cramping and fatigue, prevents flexibility.

It is not asserted that this is the only manner of penholding by which legible and rapid writing can be produced. Many hold the pen between the first and second fingers, and this position has the advantage that the pen is held in place without any expenditure of effort or voluntary muscular contraction. Writers sometimes assume this position as a relief from the fatigue caused by continually making a movement in the same manner. The adoption of an alternative position as a means of relief by one in whom the writing habit is mature does not, however, justify the same procedure on the part of the child in whom the habit is in the process of formation. It is first necessary that the habit of writing in one particular manner be well formed in order that the action may become easy and mechanical. The only modifications which should be made are in the direction of adapting the standard form of movement to the individual peculiarities of the child. Radical changes made during the formative stages, unless they are imperatively demanded by the failure of the present method, only disorganize the movement and keep it in consciousness when it should be becoming automatic. Continual experimentation with the method of performing an act, except in the sense of gradual improvement in

the details, has the same effect upon progress as pulling up a plant by the roots has upon its growth.

Experimentation is, of course, necessary to determine finally what the best form is, but it must be made with due deliberation, by the teacher or person in authority, and in such manner as not to disturb the children's half-formed habits. An experiment should take a child from the beginning and carry him through a consistent plan of training, and not, as has so often been the case, attempt a radical reorganization of his manner of writing three or four times in the course of his education, and leave him with no well-organized habit at all.

Related to the manner of holding the pen is the position of the hand. In fact, all the elements of position, movement, and posture are related to one another, and this must be kept in mind in order to appreciate some of the rules which are laid down. The chief question regarding the position of the hand as a whole is whether it should be allowed to turn over so that it rests upon the side, or whether it should be held in such a position that the wrist is level, or nearly level. The orthodox rule of writing teachers used to be: keep the wrist level; and the pupil was

often required to keep a coin upon the wrist to insure that it did not turn over. This, in its extreme, is now pretty generally recognized to be an artificial requirement, and is considerably relaxed.

The requirement of a level wrist is made in order to place the hand in such a position that it can easily slide upon the supporting fingers. This possibility of easy movement is necessary whether the extreme arm movement is used or not. If the hand rests over on the side, there is great danger that it shall remain stationary, while the fingers not only form the letters, but also produce the forward movement. In this case the hand becomes cramped and the finger and arm movements alternate instead of working together simultaneously. Of course, in order that the arm movement may be used to form the letters, it is essential that the hand rest upon a base which permits it to slide easily over the paper. If this general requirement is met, some latitude may be allowed in the precise degree of inclination of the hand. To hold the hand so that the wrist is level requires a good deal of muscular effort due to the fact that in this position the two bones of the forearm, the radius and the ulna, are crossed. Furthermore, some variation in the degree of

inclination of the hand is desirable in order to make possible the movement of pronation which, as has already been pointed out, is useful in maintaining uniformity of slant throughout the line. If this movement is used, the hand is inclined to the right more at the beginning than at the end of the line. There therefore cannot be any one fixed degree of inclination which should be maintained.

Position of the arm

The position of the arm is closely related, in some of its aspects, to the slant of the writing and to the position of the paper. The part of the discussion which deals with these aspects will therefore be deferred and treated in connection with the discussion of slant. Other aspects of arm position may be treated here.

In the first place, the arm should rest with nearly the full length of the forearm upon the desk, with a possible exception to be noted presently. This gives the arm firm support upon the muscle pad on the lower side of the forearm, and it is upon this muscle pad as a sort of rolling base that much of the movement of the arm is executed. If the forearm projects more than three or four inches over the edge of the desk, the weight

of the arm is divided between the hand and the shoulder, and the arm, in executing the arm movements, must swing from the shoulder.

This movement in which the arm swings from the shoulder has sometimes been used and taught. For a flat-top desk which is most frequently used, it necessitates either having the desk very low, so that the forearm does not rest upon the desk when the arm hangs from the shoulder; or holding the arm with the elbow suspended at some distance from the body. This position is obviously fatiguing, and if the desk top were low enough so that the arm would hang suspended above it, it would lead to the writer's bending low over his work, besides being much too low for reading and other sorts of work. If a slanting desk is used, the conditions are different. The lower edge of the desk may be low enough to allow the arm to hang from the shoulder and yet the writing itself be in such a position as to be easily seen without bending over. That such an arrangement is advantageous for children in the primary grades will be argued in another place.

The position of the left hand and arm is also a matter of importance. In general terms the left hand and arm should be symmetrically situated to the right. If the right forearm rests upon the

desk, so should the left arm. If the right arm hangs from the shoulder, the left arm should also. The purpose of this rule is the prevention of an unequal elevation of the shoulders with consequent curvature of the spine.

The position of the body has been described in sufficient detail in the chapter on hygiene.

We have considered the adjustments which it is possible to conceive and make through being told and shown how. Some practice is, of course, necessary to perfect the adjustments, but *showing* how is of relatively more importance and *learning* how of relatively less importance than is the case with other aspects of the writing coördination. The above described adjustments, we have classed as form. We turn now to the other aspect in which *learning* how is the predominant means of improvement.

Learning to execute the movement: the trial and success method

Certain positions which do not involve complex adjustment or which are not particularly novel can be assumed through imitation, but a complex movement each person must largely learn for himself. The method by which one learns to make complex motor adjustments has

been aptly called the trial and success (or trial and error) method. This method may be used in other sorts of learning, but it is in the development of motor skill that it is paramount. No extended description is necessary to describe it. The name is sufficiently descriptive. A clear notion of its significance may be gained by reverting to Chapter II. We there saw that the process consists in the gradual elimination of useless movements and the organization of the movements which are concerned in the act into a harmoniously working group. On the physiological side this process is due to the establishment of connections between the higher centers of the brain (those which represent the meaning, the appearance, and the sound of words, etc.) and the centers for the muscles used in writing, together with connections between the centers controlling the various muscles themselves. The formation of these connections consists in the establishment of paths of low resistance to the passage of the nervous current. This leads to the withdrawal of excess energy from other channels and hence to the elimination of other movements than the ones desired.

Though the child has to learn to make the writing movements through his own efforts, and

through them alone, there are certain conditions which are under the control of the teacher, and certain points toward which the teacher may direct the attention of the child, which make progress more rapid. To these we shall now turn.

The need of many repetitions

It is characteristic of all acts which are learned by the trial and success method that they cannot be perfected at a stroke. There is no royal road to their acquisition, but they must be learned through a great number of trials or repetitions. It is not a question of knowing how to perform the movement, but rather of gaining the requisite control over the muscles by which it is made so that when we think of the movement or of its results the appropriate muscles will contract each in its proper time and with the proper force. Since we have no means of knowing how to make a new movement except as it resembles movements we have learned before, or involves very simple combinations of movements over which we already have control, our only means of learning is to try, and when the trial movement succeeds, repeat it in the same way.

The difficulty which attaches to the performance of the desired movement and to the repe-

tition of the correct performance is due to the great variety of the elementary movements which compose the complex system. Even after the constituent movements have been made together once, it is difficult to repeat the performance. The new centers have to become so accustomed to working together that they do so smoothly, and that excess energy does not overflow into other channels.

The multiplication of repetitions of a movement is sufficient to make it easier, but in order that it shall increase in accuracy as quickly as possible, certain other conditions are essential. Mere repetition may not produce improvement but may rather serve to fix bad habits. In order that the repetitions may be of value for improvement, it is necessary that the pupil give full attention to some phase of the writing and strive to bring it up to some definite standard.

The necessity of attention

This principle that repetition must be accompanied by improvement if it is to be of much value has several practical applications. The first is that the pupil must give a high degree of attention to his work.

As a general rule, attention is necessary in

order that improvement may take place. When the activity becomes automatic, that is, when it is made without attention to the process, the mode of action becomes fixed. Consciousness is concerned with new adjustments and is necessary in order that new adjustments may be made. Whenever practice is for the purpose of causing improvement, then, it must be carried on while the pupil is giving full attention to what he is doing.

Some writers on learning have held that there must be periods during which there is no improvement. These periods are called plateaus, since during such periods the learning curve for a time remains level. There is evidence in support of the belief that, contrary to prevailing opinion, plateaus are not essential, but are due merely to the fact that the learner has at a certain point failed to keep his attention properly directed. Certain mental or physical conditions may make it very difficult to keep attention constant, but the period of marking time which ensues is not to be regarded as one which is necessary in order that further adjustments may be made; but is, at the best, a period in which adjustments previously made are becoming automatic. The new view, in contrast to the older one, is that the older adjustments may be made automatic at the same time that

new ones are being formed, so that no break in progress is necessary.

Incentives to attention should be chiefly intrinsic

For consistent progress, then, repetitions must be attentive. The attention of the child to his writing may be gained through motives which are extrinsic or intrinsic to the problem before him, which is the efficient production of written forms. Extrinsic motives are, for example, rivalry, the approval of the teacher or parent, or punishments and rewards. Intrinsic motives are the pleasure in rhythmic movement, the pleasure in making pleasing forms — a form of the constructive instinct — and the pleasure in overcoming difficulties and in raising one's past record.

It is probable that we do not sufficiently rely on the intrinsic motives. When the repetition becomes mechanical and meaningless, it is natural that the child should lose interest and that we should appeal to outside motives. But if the child be kept continually conscious of the problem before him and of the point at which improvement should be made; if he compares his work more with his own previous attainment than with the work of the child who has more aptitude than he, his incentive to effort will be stronger.

Extrinsic motives also have the disadvantage that they are apt to lead to wrongly applied effort. While it is, of course, evident that there cannot be too much concentration of the attention, there may be too much effort at concentration. Likewise there may be too much effort directed toward speed or form. Too great effort is apt to overreach itself, to disorganize the movement, and to cause a lapse in progress. This seldom occurs when the learner is absorbed in the process of learning, but it often happens when he is conscious of losing interest and tries to spur himself on by external considerations.

We have found that in order that there may be much improvement through practice the child's attention must be upon what he is doing, and he should be thinking chiefly of the forms which he is producing, and of the improvement of the forms or of the movement by which they are produced, rather than of some outside fact or condition which acts as an extrinsic motive. In order that his attention may thus be on his writing it is necessary that the child have some specific difficulty in mind which he is striving to overcome.

This means something more than that he is trying to follow a copy. The child can readily

see that his writing departs widely from the copy; but his difficulty is to see just in what particular ways it differs, and what he must do to make that difference less. To this end he must know how to analyze the faults of his own writing, and must have some notion how to overcome them. He can then have some definite point toward which to direct his attention and in reference to which he can note his improvement.

It is one of the chief purposes of the scale which is described in the last chapter to enable the teacher to make an analysis of the pupil's writing and to help him to make it for himself. For example, a very common fault of writing and one which at the same time has a great deal to do with its legibility and is one of the most easily remedied, is bad spacing. Good spacing may be attained by having a good standard in mind and giving some thought to its attainment. On the other hand, such faults as irregularity of slant or of alinement must be corrected primarily by the attainment of regularity of movement.

A detailed analysis of the faults which appear in the child's writing and of the adjustments which are necessary to correct them has been worked out by Mr. W. C. Reavis, Principal of the Laclede School, St. Louis, Missouri, on the

basis of his experience in supervision, and is here presented with his permission.

Analysis of defects in writing and their causes, in use by Principal Reavis

Defect	*Cause*
Too much slant	1. Writing arm too near body. 2. Thumb too stiff. 3. Point of nib too far from fingers. 4. Paper in wrong position. 5. Stroke in wrong direction.
Writing too straight	1. Arm too far from body. 2. Fingers too near nib. 3. Index finger alone guiding pen. 4. Incorrect position of paper.
Writing too heavy	1. Index finger pressing too heavily. 2. Using wrong pen. 3. Penholder of too small diameter.
Writing too light	1. Pen held too obliquely or too straight. 2. Eyelet of pen turned to side. 3. Penholder of too large diameter.
Writing too angular	1. Thumb too stiff. 2. Penholder too lightly held. 3. Movement too slow.
Writing too irregular	1. Lack of freedom of movement. 2. Movements of hand too slow. 3. Pen gripping. 4. Incorrect or uncomfortable position.
Spacing too wide	1. Pen progresses too fast to right. 2. Too much lateral movement.

In order to intensify the child's interest in his progress in overcoming the difficulties of writing, a definite record should be kept of his progress.

This may be done by giving grades based on a writing scale supplemented by specimens of his writing which are taken and preserved at regular intervals. This is a much more stimulating and encouraging record for those pupils at least who have rather less than the average ability than is the common method of comparing the various members of the class with one another. This procedure assumes that all pupils have equal ability in the subject in question, and that their standing depends upon their industry only — a false and pernicious assumption. In such a subject as handwriting, in which a definite record of attainment can be kept, the pupil's achievement should chiefly be compared with his own past achievement rather than with that of others.

Length and frequency of periods of practice

In order that the child's attention may be upon his task it is not only necessary that he have the right mental attitude toward his work and the proper motives to pursue it. His physical condition has an important effect upon his attention and upon the speed with which he learns. We are concerned here with his physical condition only so far as it is affected by the work itself. When a person practices a new activity contin-

uously for a certain period of time the amount of benefit he derives from the practice becomes less after a certain length of time and finally disappears altogether. This diminution in the rate of improvement may be attributed to fatigue and the consequent wandering of the attention.

Fatigue appears especially early when new activities are being learned and varies also with the age and individuality of the learner. A number of experiments have been performed to ascertain the best length of period in different kinds of learning. In general these experiments have shown that in learning of a mechanical sort the same amount of time cut up into short periods of practice produces more rapid progress than when divided into longer periods. It may safely be said that in the first five grades frequent periods of ten minutes each will give better results than periods of greater length held less frequently. It is probably never advantageous, at least in the elementary school, to extend the practice period beyond twenty minutes.

Imitation of a person writing better than imitation of a copy merely

It has been said that the child should be stimulated to improvement not merely by setting a

copy before him, but also by leading him to make an analysis of his own writing. This raises the whole question of the place of imitation in learning to write. Two kinds of imitation may be employed: the imitation of a finished product or specimen of writing, and the imitation of a person who is going through the process of writing. The first kind of imitation is employed when the copy-book or copy slips are used. The writer has pointed out in another place that the trend of modern practice is decidedly away from a reliance upon the copy-book as the chief means of teaching.[1]

This trend in the teaching of penmanship is analogous to the change which took place in the teaching of drawing in the latter part of the nineteenth century, and the basis for the change is very much the same in the one case as in the other. The arguments for and against copy-books may briefly be stated. The copy-book is regarded as of advantage in teaching writing, first, because it presents to the child what is regarded as a perfect model for him to imitate. The belief is that the more perfect the model which is set before the child the closer will be his approximation to it.

There are several fallacies, however, in this position. In the first place, the engraved model is the

[1] "Current Methods of teaching Handwriting," *Elementary School Teacher*, 1912, vol. XII, p. 429.

lifeless result of writing and not the process of writing itself. The child can very much better imitate the process of performing an act than the result of the act after it has been completed. Therefore, the sight of a teacher writing presents to the child in a very much clearer form the process of writing which he has to develop. The whole emphasis of present-day teaching is upon the development of the movement by which the child produces letters and not upon the result as divorced from the movement. Again, the copy which is presented in the copy-book is not ordinarily a possible form of writing. It is not produced by writing in the ordinary way, and it does not, therefore, suggest the kind of writing which we wish to develop, but suggests rather the slow drawing process by which it itself was actually produced. An ideal which is impossible of attainment by the method which is to be used is a false ideal, and has no advantage above a more imperfect product which was produced by the ordinary writing method.

It may be said in reply to this argument that the teacher is ordinarily not capable of setting up a good enough model for the child. If this is the case, however, the teacher is not fit to teach the child properly even with the aid of a copy-book. In every form of teaching which involves skill or dexterity imitation is one of the best means of training, and it is clearly recognized that a person who can not perform the act himself is not qualified to teach another to do it.

To set up as a model the finished result is nowhere else regarded as a satisfactory method of teaching the process. It should no more be regarded as satisfactory in the teaching of handwriting. The remedy for poor writing on the part of the teacher then is not the substitution of the finished product in a copy-book, but is rather an acquisition of skill on the part of the teacher. This is no unreasonable demand of any person who possesses the average degree of manual skill.

We must then give up the notion that writing can be taught in a mechanical way merely by setting before the child models for him to copy and providing for him a space which he is to fill. In the subject of writing, as in the other subjects of the curriculum, we are coming to recognize that the function of the teacher is to guide the learning process of the pupil and not merely to set tasks and hear lessons. Each child has his own problems which are more or less individual and these require the guidance of a living intelligent teacher rather than a mere lifeless model.

The special methods adapted to different grades

The adaptation of the character of the teaching to the needs and ability of the pupil has another aspect in the variations in method and content which are necessary in order to make

them suitable to the children of different ages. Failure to make this adaptation adequately has been characteristic not merely of copy-book systems, but also of methods which lay stress upon movement drill. More progressive systems of both kinds are now, however, making modifications of one sort or another to suit the different grades. In the case of the copy-books the main changes which are introduced are the use of large coarse writing in the copy for the lower grades and the introduction of pictures and of text which is interesting to the child. The chief modification in movement-drill methods is to defer anything like exacting drill until the third or fourth grade. Some of the most widely used systems, however, have not yet made such obviously rational concessions to the demands of child nature. The adaptations which are necessary to meet these demands we may consider in further detail.

Handwriting in the primary grades

When the beginner may be taught. Some writers have advocated deferring all writing until the third or fourth grades on the ground that the writing activity is too exacting upon the nervous system of the primary child because it requires

finely adjusted movements and general immobility of body. On the other hand, the widely exploited Montessori method has as one of its most prominent features the instruction in writing of children of kindergarten age.

The views of those who would defer writing are not without reason, but the objections upon which they are founded can be met without such radical changes as are demanded. The Montessori method attempts to meet these objections by introducing the child to writing by a series of steps which are so well graded that he enters upon each succeeding step without great difficulty or nervous exhaustion. The chief distinctive feature of this method is training in the perception of form by handling objects of various geometrical form, by using the pencil in filling in spaces, and by tracing with the fingers letters cut out of sandpaper, before any attempt is made to write. The child thus becomes familiar with the general shape of the letters by the direct processes of touch and movement before he undertakes the rather difficult specialized activity of producing them with a pen or pencil.

Some such exercises preliminary to writing itself are doubtless of value. When the child begins writing proper, however, the problem is not ended. At this point the Montessori method

leaves us. It is apparent from the appearance of the children who learn by that method — according to the writer's observation of photographs taken in Rome — that the children often exhibit a cramping of the hand from which those who are taught by the best methods in the United States are free.

His writing should be very large. The writing of the beginner should have two characteristics. It should be very large, and it should be done with the arm as a whole rather than with the fingers. These two prescriptions are related and their reasons are fairly obvious. In the chapter on "Physiology and Hygiene" it was pointed out that the child is capable of much less precise movements than is the adult, and that there is a steady progress in precision of movement with age. Now it is clear that a large letter can be made with much less precision than a small one without producing any greater departure from the true form of the letter. The same amount of deviation forms a much smaller proportion of the whole. This conclusion is confirmed by the universal experience that it is easier to write in good form on the blackboard than upon paper.

He should write with the arm as a whole. The

second requirement follows from the first. If the child writes with the fingers his writing is almost sure to be comparatively small — in the natural trend smaller than the adult's — because the range of movement of his fingers is less.

The movement in which the arm as a whole is most readily employed, as distinguished from the fingers, is the so-called whole-arm movement which is made without resting the forearm on the desk. In order that this movement may be properly carried out the desk top should have a slant of at least fifteen or twenty degrees, as has already been said. Under these conditions the front edge of the desk will be low enough so that the child's elbow will clear it when the arm hangs from the shoulder. The movement cannot be properly made with a flat-top desk at such a height that the elbow must be held up at a distance from the body. This position is fatiguing and results in the formation of a habit which is difficult to break up in the higher grades.

When the conditions make it impossible for the child to make the whole-arm movement properly, the next best procedure is to use the arm movement with rest and require the child to write as large as his arm will permit. It will be possible to obtain writing in which the one-space letters

are nearly one-half inch in height if pains are taken to develop flexibility of movement.

Besides being less precise this type of writing has other advantages. When the child begins to write, as was said in a previous chapter, there is a good deal of diffusion of the nervous impulse. The muscles of the fingers, being the more easily contracted, are affected by this diffused impulse more than are the larger muscles at the shoulder. In fact the fingers become over-contracted, as observation of children writing reveals. To avoid this over-contraction it is necessary to encourage the use of the arm as a whole.

Appropriate standards of size, speed, and accuracy. These two requirements of size and arm movement are met in highest degree by blackboard writing, and accordingly this has been found to be the best form with which to begin. When the child begins to write on paper after several months of blackboard writing, he should use rough-surfaced paper, large, smooth pencil or crayon, and should continue to write large. For a time the one-spaced letters may be one half inch high. The height may be gradually reduced until in the third grade the child is using letters about half as high. If ruled paper is used, the lines should be an inch and a half apart to start with, about an inch

apart in the low third grade, and so on. Not until the upper grades at least should lines as close as three eighths of an inch be used, if then. A very common fault in writing, which reduces its legibility greatly, is the crowding together of the lines. Since school pupils commonly use ruled paper this fault must be ascribed in the main to the closeness of the ruling. The only consideration favoring crowding the lines is economy in paper, and this is not of sufficient importance to outweigh the importance of legibility.

The requirement as to speed. As the requirements on the score of accuracy should be less severe than those imposed upon the older pupil, so also should he be required to write less rapidly. Not only is he less capable of rapid movement in general, as all experiments have shown, but he is less adept in this particularly difficult and complex movement. This is not always recognized. The worst delinquents in this regard are some of those who emphasize arm-movement drill. They sometimes make no distinction at all between the speed required of the different grades, and the resulting scrawls cannot be justified on any score. The child should write slowly enough to enable him to make the letters with some semblance of their true form and with some regularity. Certain

sorts of irregularity are natural in his condition of undeveloped control, but they should not be exaggerated by undue haste.

In a study of the rate of movement of children in the grades it was found that children of different ages differed widely in their ability to make up and down strokes rapidly.[1] The median grammer-grade child made about twice as many strokes per minute as the median first-grade child. Not over one hundred double strokes can be expected of the first-grade child, while about two hundred can be made by the upper-grade child. The speed of writing letters does not increase as rapidly as the speed of making simple strokes, since the more rapid writer, as was shown in a previous chapter, spends a larger proportion of his time on the complex parts of the letters. The difference is sufficiently great, however, to justify making much greater demands in the matter of speed of the mature than of the immature writer.

We should not, then, expect either a high degree of accuracy or a high speed of the beginner. On the other hand, the child should write with sufficient fluency so that the successive stages of

[1] "Current Methods of teaching Handwriting," *Elementary School Teacher*, 1912, vol. XIII, p. 32.

the movement are fused together into a whole complex movement. If the movement is slowed down beyond a certain point it ceases to be a single movement and becomes a succession of movements. In the earlier stages, to be sure, it must be slow enough so that the eye may be used to guide it and keep it from going too far astray, for we have found that the child exercises greater visual control than the skilled writer; but this control should be used only to modify the direction of the movement in course, and, not to stop it entirely and start it in a new direction. Only if the movement is continuous can improvement be made in the ability to produce fluently a form the image of which is in the mind. The learner must come to know what it feels like to make the movement needed to produce the form, and this he acquires only when the movement can be experienced as a whole.

The standards of speed and accuracy must advance together. On the side of form also a certain minimum of excellence must be maintained in order that practice may be of profit. The mere making of movements which have the outward semblance of writing is of little if any value. The child is not by this process acquiring an image of the form of the letter, for it must not be forgotten

that the image is only perfected by the actual carrying-out of the idea into action. The order is not first a concept, then its reproduction; but first a vague, very imperfect notion, which is refined and perfected by the attempt to realize it in action. The writing activity plays an important part in the acquisition of the idea of the form of the letters. The pupil by writing carelessly is therefore only acquiring slovenly ideas which he will later have to displace. In writing, then, as in other forms of skill, the standard in speed and accuracy must advance together. The demand for either the speed or the accuracy of the expert in the beginner is founded on wrong educational principles. Whether the learner progresses with equal rapidity in both forms of excellence in the different stages of his learning, or what the precise relation of the two should be, has not been determined.

It is not the place here to give in detail a series of exercises or lessons to be used in teaching writing. Such plans may be found in the various published manuals and exercise books. We may merely lay down certain principles which should underlie the detailed course of procedure, and from these the individual teacher may work out her own course or may select in the light of these

principles details of procedure from the various published courses or systems.

Writing should have meaning to the child from the beginning. From the beginning writing should have meaning to the child and should be connected with his reading and other language activities. Not much detailed analysis of letter forms should be made nor should perfection of form be demanded. The old method of requiring the child to make first the simple letter elements or "principles," and then leading him out of these to build up letters and words, starts at the wrong end. A few elementary movement drills, such as the straight line and direct and reversed ovals, may be practiced for the purpose of gaining control and freedom of action; and the appropriate letters may be made in connection with these drills. But such drills should be incidental to actual writing and not preliminary to it. The order of procedure is to choose some simple word which is already of significance to the child, write it for him on the board, have him attempt to copy the word through imitating the action, and finally lead him to the criticism of his product and to the practice which will produce improvement.

The words and sentences should present progress-

ive difficulties. For a considerable time the writing lesson is the only time when the child writes. Its chief purpose is to give the teacher opportunity to guide the child's early efforts to write. In order to make the task progressive in difficulty words may be chosen in such an order as to include first easy letters and letter combinations and then successively harder ones. For example the word "see" is one which is likely to occur in the child's reading and is well fitted because of its simplicity as a beginning word. The one-spaced letters are in general suited for the first work, followed by the two- or more-spaced letters and the capitals. The classification of the letters in Fig. 8, page 107, may serve as a suggestion of the general order of the letters, but no such classification can be strictly followed, and the difficulty of the connection between letters as well as of the letters themselves must be studied. Furthermore the simpler two- and three-spaced letters may be used before all the one-spaced letters have been written and the easier capitals before the harder small letters. Following the principle that writing should have meaning, sentences must be used early and this involves the use of capitals.

The value of formal drill. A word may be said regarding the value of formal drill preliminary

to writing for the purpose of leading to some degree of movement control and for developing general acquaintance with the forms of the letters. Such drills have been made familiar in the Montessori method. The chief value of such methods is that they give the child the motor experience which corresponds to letter forms. That is, in such an act as tracing over the sandpaper letters with his finger he finds out how it feels to make the movement, and this feeling of the movement gives him the cue which enables him to make it again. The sandpaper merely acts as a motive to move in the proper direction. It supplements the sight motive by the touch motive. The other preliminary exercises of the Montessori system, as drawing and filling in outlines, serve the purpose of giving the child practice in handling the pencil. The aspect of the method by which the child is enabled to write words spontaneously and to spell out new words is based upon the phonetic drill which the child undergoes in putting together cardboard letters and is made possible in large measure by the phonetic character of the Italian language.

Individuals vary in capacity and needs. In teaching primary writing especially, attention to the capacity and needs of the individual pupil is

necessary. Some pupils can write from the start with little difficulty. Others need constant guidance and help.

What may be required by the end of the third year. By the end of the third grade the child should have become somewhat accustomed to the use of the pen; he should be able to write a large hand, making well-formed letters with a fair degree of fluency, say fifty letters a minute; and should have made a beginning in the use of writing as a means of expression of his thought. He has had lessons in writing, but they have been occupied mainly in supervision of his general position and mode of carrying on the movement, and in some analysis of letter forms, and have included little formal drill. During these first years, as indeed during the whole of his school career, the character of the writing in all the work in the school should be carefully supervised.

Handwriting in the intermediate grades

When he passes to the fourth grade the child is coming into possession of a considerably higher degree of motor control. Moreover, he can become interested in perfecting his control through well-directed drill. This drill, as has been said, must not be mechanical, but if the child can be

made to see his progress he will be interested. The habit of movement which is to be the permanent one should now be learned if it has not been acquired previously. A judicious use of movement exercises may now be made. To a consideration of the best forms of movement and of movement exercises we next turn.

The best type of movement. The various forms of movement which are commonly used in writing may be best described by the terms "free-arm movement," "arm movement with rest," "finger movement," and "combined arm and finger movement." Some writers employ still another movement — that of the wrist. This is made by an alternate flexion and extension of the wrist with the hand turned over on the outside, and is to be distinguished from the side-to-side movement which may be made to carry the hand along from letter to letter. The wrist movement is rather common among Europeans and serves to make the writing freer than when an extreme form of finger movement is used, but the necessity which it entails of turning the hand over on the side impairs the free progress of the hand along the line. We may therefore dismiss it from our consideration.

Of the four other forms of movement or of

movement combinations which are mentioned above, the free arm movement has already been advocated as suitable for the coarse, free writing of the first three grades. Now, however, the child's writing must become smaller and more accurate. It is much easier to make an accurate movement when the arm and hand are supported, and as the child attains greater maturity and motor control there is not so much danger that the fingers will be excessively cramped through diffusion of the nervous impulse. Hence some form of movement with the arm resting on the desk should now be adopted.

The practical issue is between the arm movement with rest and the combined finger and arm movement. The combined movement as distinguished from the extreme finger movement includes a free side-to-side movement of the hand and arm along the line while the fingers form the letters, and, it may be, in addition, a slight upward and downward oscillation of the arm as the letters are being formed. In the extreme forms of the arm movement the arm does the whole work, including the formation of the details of the letters.

The difference here indicated between the arm movement with rest and the combined movement

is not great or very important. If a strict adherence to the demand for the entire exclusion of the movements of the fingers is maintained, considerable drill will be required beyond that amount necessary to form the habit of a satisfactory combined movement. As a matter of fact, the amount of drill given in the elementary school does not suffice to produce this result in the majority of the children.

The arm movement with rest — the so-called muscular movement — is an American discovery and has been vigorously exploited in commercial schools since the last quarter of the last century and more recently in certain systems of teaching in the public schools. It seems likely that within twenty-five years this form of writing will be practically universal in American schools. The chief advantages of the movement are two. In the first place, it is made with the fingers relatively relaxed, thus avoiding cramping. In the second place, the rolling movement of the arm upon the muscle pad of the forearm produces a firmness and evenness of line, and the fact that the movement is produced from a center at a considerable distance from the pen point results in regularity of slant.

The survival of this type of movement may

depend upon a discriminating view of its merits and defects upon the part of its advocates. If it is made to do more than its fair share of work or if its merits are insisted on with too uncritical enthusiasm, opportunity will be given those who may find profit in picking flaws in it and in leading to a reaction to a different kind of movement. The use of the movement by beginners, in the writer's opinion, furnishes such ground of attack. Another ground is the over-emphasis of movement drill to the neglect of an analysis of the form of the letters. Finally, the contention that every detail of the letters shall be made by the movement of the arm while the fingers remain immobile is calculated to antagonize reasonable critics. The oscillation of the arm may well form the main basis for the upward and downward strokes of the letters, but to require that every loop and turn and joining be produced by the movement of the arm as a whole, instead of the much more flexible hand and fingers, is to set up an artificial requirement and one which is not made in regard to other types of skilled movement.

The form of movement, then, which best meets the requirements which may be laid down as the result of experiment and of practical experience

is somewhat as follows: The hand and arm must be so adjusted that the hand progresses freely along the line during the formation of the letters and in the spaces between words. The hand must rest upon some freely sliding point or points of contact such as the finger nails or the side of the little finger. When, on the contrary, the pen point is carried along from one letter to another by means of adjustments of the parts of the fingers and the hand, the hand continually gets into a cramped position.

The movements of the arm and fingers should form a smooth and easy coördination in which there is a condition of flexibility in the whole member. The rotation of the arm upon the muscle pad of the forearm as a center carries the hand along, the upward and downward oscillatory movement forms the groundwork of the letter formation, and slight adjustments of the fingers complete the details of the letters. In addition to these chief elements of the movement the wrist may rotate to the side to supplement the sideward movement of the arm, and the forearm may revolve upon its axis in the movement of pronation as a corrective to the increase in slant at the end of the line. There is no good reason for seeking to eliminate any of these component movements.

Each has some part to play. Moreover, room must be left for individual differences in their relative prominence and manner of combination.

Position of the paper and of the arm, and slant. In the early part of the chapter the question of the position of the paper and of the arm in relation to it was deferred, since these matters related to the type of movement which is used. Connected with them also is the problem of slant, so that all these questions should be considered together.

In the chapter upon the "Physiology and Hygiene of Writing," the bearing of the position of the paper and of the slant of the writing upon the health of the child was discussed. The situation in brief is this. In the last quarter of the last century a number of physicians, particularly in France and Germany, found that the mode of writing then in vogue produced spinal curvature and eye-strain. The position commonly assumed in writing was the side position with the right arm on the desk and the left arm off; and an extreme slant was commonly used. In correcting posture it was believed that the slant of writing must be done away with. That this does not follow appears from the

considerations presented in the former chapter. We may now consider what principles should govern slant and the position of the arm and paper.

The fundamental considerations which govern the slant which should be adopted are those of movement. There has been extensive controversy over the question whether a straight front position of the paper (resulting in vertical writing) or a tilted position conforms better to the eye movements. The evidence for the tilted position is as convincing as that for the straight position, and the question must therefore be settled on other grounds.

Two general features of the writing movement determine the answer to the problem. In the first place, the arm and the paper must be in such relation that the rotation of the forearm about the elbow as a center carries the hand along the line of writing. This means that the paper must be tilted to the left until the line of writing is about at right angles to the forearm. The second principle is that the most natural direction of the upward and downward strokes of the writing is toward the body — or about at right angles to the edge of the desk. This makes the writing deviate from the vertical by the same angle that

the paper is tilted. The relationships are illustrated in Fig. 3.

The other argument besides that based on hygiene is to the effect that vertical writing is more legible than slanting writing. When the writing conforms to the standard form this is true. But the difference is not great, even if it does so conform, and when it does not, as is often the case, vertical writing may become as illegible as slanting writing. The superior legibility of vertical writing lies partly at least in the sharp contrast between the direction of the vertical strokes and the connecting strokes, which results in the sharp marking-off of the letters from one another. In rapid writing the various strokes tend to be

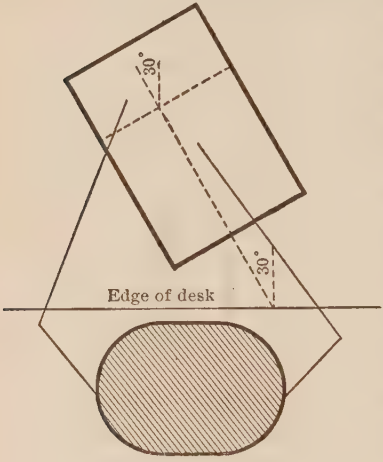


FIGURE 3
Diagram of the relation of the body and arms to the desk and the paper.

made in the same direction, whether vertical or slanting. When this happens vertical writing may become very illegible, as may be observed in Fig. 4.

This tendency for the succeeding strokes to have the same direction constitutes another reason why, from the point of view of movement,

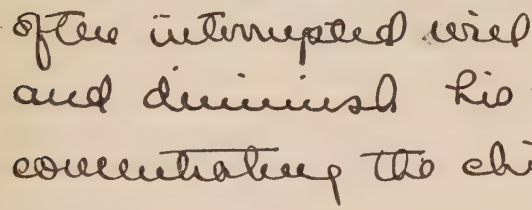


FIGURE 4

Specimen of vertical writing showing assimilation of the upward to the downward strokes in direction.

writing has usually had and should have a slant. The connecting strokes having a slant, the other up-and-down strokes are naturally influenced in the same direction.

No fixed rule as to the degree of slant which is best can be given. In general, extreme slant is unnecessary to satisfy the requirements of movement. A slant of not more than thirty degrees from the vertical therefore is to be recommended.

Movement drill. The elaboration of the tech-

nique of any act of skill usually implies some degree of formal drill for the purpose of its acquirement. When the individual is performing the act in its practical setting, his attention is largely taken up by the result which he is to attain and he loses sight of the adjustment and of its improvement. It is true that the child probably falls into a new adjustment more readily than does an adult, particularly if he can imitate a skilled performer. But in the case of a difficult and complex act such as handwriting some formal drill hastens progress and produces greater skill.

A large number of forms of movement drill have been devised. Certain drills are used pretty universally and the differences which exist are chiefly in matters of detail. We may distinguish in general two types of drill, one which is purely formal, and the other which is used in connection with the actual production of letters. Of the purely formal drills the most frequently used are the retraced oval in both directions, the straight up-and-down stroke, and the retraced horizontal stroke. The continuous, progressive oval may be looked upon as a modification of the retraced oval. Somewhat less frequently used forms of drill are the continuous *m* stroke, *u* stroke, and *l* stroke (see Fig. 5). The aim of these drills is

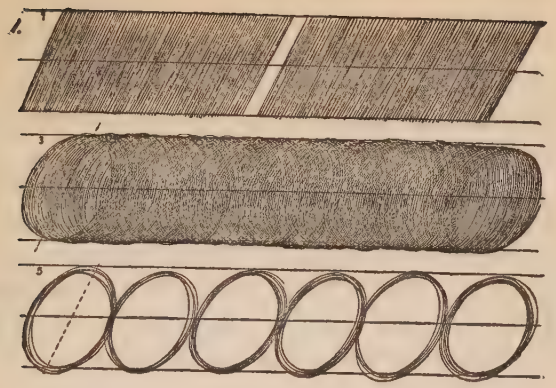

1.
2.
3.
This exercise was done with the Forearm Movement. Notice the smooth lines.
10 L
The right circle (R) with the Forearm Movement.
10 R
The "X" indicates the starting point.

FIGURE 5

Illustrations of formal drills. From *Elementary School Teacher*, 1912, vol. XIII, page 28. (Reproduced with the permission of the University of Chicago Press.)

evidently to give the pupil practice in the use of the arm movement in the production of the letters.

Another type of drill is particularly directed toward the development of the arm component in carrying the hand along the line while the letters may be produced by the finger and the hand. This type of drill has been particularly developed in the Bennett method (see Fig. 6).

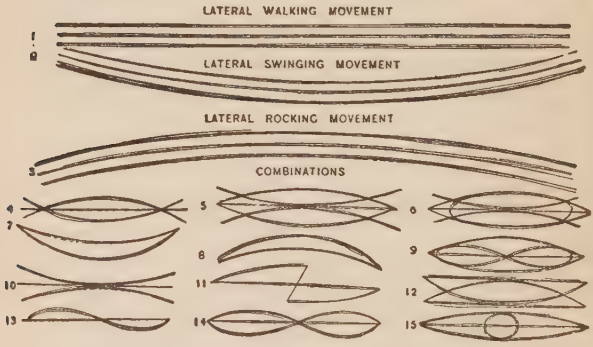


FIGURE 6

Illustrations of the lateral movement drills as used in the Bennett system. Reduced to one-half size. From *Elementary School Teacher*, 1912, vol. XIII, page 29. (Reproduced with the permission of the University of Chicago Press.)

This method, in fact, excludes entirely the oval and up-and-down drills. The drills which are

included in this method are the back-and-forth horizontal stroke, the so-called swinging and rocking stroke, and the development of the *i* and the *n* out of a combination of these strokes with an intervening downward stroke. This forward-and-backward movement is used even in the development of the letters themselves, as well as in the movement between the letters. Thus *a* is produced by a combination of the rocking and swinging movement with the downward movement following. This same lateral movement is emphasized in certain drills used by Houston, Berry, and others (see Fig. 7). These drills consist in a succession of letters which are connected by strokes an inch or more long. In such a drill it is necessary to combine smoothly the movement which produces the letters and the movement which carries the hand across the page. Since this touches upon the essential problem in the development of the writing coördination, the writer believes that such drills are of the highest importance. The oval and the straight up-and-down stroke are useful to develop an easy, flowing movement.

Only the commonly used formal drills have been here referred to, since more labored forms are a matter for individual choice. A great many

drills which consist in retracing letter forms or incorporating into the formation of the letter one of the formal drills, have been devised. These may be useful in compelling the pupil to use a

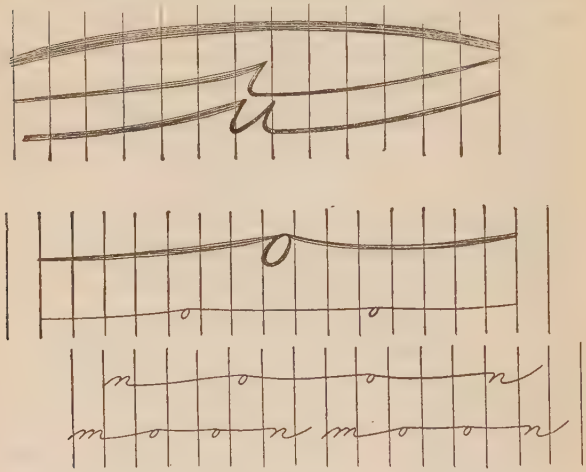


FIGURE 7

Illustrations of exercises with laterally spaced letters. From Houston's *Copy Slips* for Grade III. From *Elementary School Teacher*, 1912, vol. XIII, page 30. (Reproduced with the permission of the University of Chicago Press.)

free movement in the production of the letter, but are of less importance than the more formal drills.

Rhythm and counting. A very important aspect

of the teaching of movement drills, and in fact of the best form of movement in writing itself, is rhythm. Experimental investigations have shown that one of the main differences between the writing of the child and of the adult is that the latter is very much more characterized by rhythm than the former. That is, the adult tends to write in time as though to music. The successive strokes, though very different in length, tend to approximate each other in time. It has also been shown that the use of an imposed rhythm, that is, the requirement that the child write according to a certain rhythm, tends to unify his writing and render it more mature in character.

The count is usually made upon the down stroke of the letter, though at least one method gives the count on the sideward or connecting stroke. The important thing is that regularity and continuity be introduced into the movement. The time is usually marked by counting, making a series of raps with a ruler, handclaps, or metronome beats. A still better method of indicating tempo, which has long been used for marching, dancing, gymnastic exercises, etc., is music. This adds still more to the pleasure of rhythmic movement.

The rate of count should be regulated according to the age and degree of progress of the pupils.

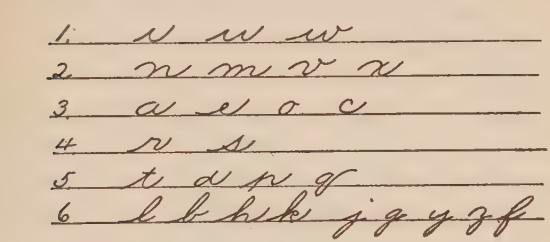
The rate of two hundred double strokes a minute which is commonly used is too rapid for those who are beginning movement drill, but may be perhaps attained at the end of a year's practice.

Care should be taken to see that the pupils are actually following the rhythm. Some pupils have little sense of rhythm and a few may perhaps have to be left to go their own pace.

Letter groups on the basis of movement. An intermediate step between purely formal drill and writing is drill in the writing of certain classes of letters in connection with the formal drill with which they are most closely related. Thus certain letters, as the capitals *O*, *C*, *A*, *G*, *D*, and *E*, are made by the direct oval movement with slight variations. For the purpose of this drill on letters they may with advantage be classified and those which are made with similar movement practiced in connection with the corresponding formal movement drill. The accompanying figure illustrates the most complete classification made on this basis with which the writer is familiar.

In this system the small letters are divided into six groups, as follows (see Fig. 8): first, *i*, *u*, and *w*, which are based upon the direct oval; second, *n*, *m*, *v*, and *x*, which are based upon the reverse

oval; third, *a*, *e*, *o*, and *c*, which are also based upon the direct oval, but are regarded as more complex than the first group; fourth, *r* and *s*,



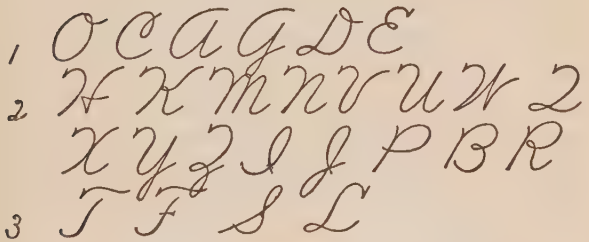


FIGURE 8

Classification and order of development of letters in the Economy System. From *Elementary School Teacher*, 1912, vol. XII, page 484. (Reproduced with the permission of the University of Chicago Press.)

which are miscellaneous letters; fifth, *t*, *d*, *p*, and *q*, which have in common the straight up-and-down line; and sixth, *l*, *b*, *h*, *k*, *j*, *g*, *y*, *z*, and *f* which have the upper or the lower loop in

common. The first and third groups might very well be placed together, since they are based upon the same type of movement. This, of course, is not the only possible classification. For example, *a*, *d*, *q*, and *g* might be classed together on the basis of the similar movement which is used in making the parts which are common between these letters. Similarly, *n*, *m*, *p*, and *h* might be grouped together. The purpose of any such classification is not to make the grouping rigid, but to classify the letters for a particular purpose, that is, to secure systematic and consecutive practice. In the course of the development similarities which are not represented in the main classification may very well be brought out and made the subject of drill. Some such classification as is here suggested is to be highly recommended for the purpose of introducing system and consecutiveness to the drill.

The capital letters may also be grouped according to the similarity of the movement by which they are written. The classification will depend to some extent upon the type of letters which are chosen, but the broad lines of grouping may be illustrated again from the Economy System. The first group, which is based upon the direct oval, is composed of *O*, *C*, *A*, *G*, *D*, and *E*.

The second group, which is related to the reverse oval, is composed of *H*, *K*, *M*, *N*, *V*, *U*, *W*, *Q*, *X*, *Y*, *Z*, *I*, *J*, *P*, *B*, and *R*. The third group is composed of the complex letters *T*, *F*, *S*, and *L*.

Organization of exercises. This system of classification suggests the order of exercises suited to develop the letters in connection with their appropriate movement drills. The objection to an analytic type of procedure does not hold here as in the case of the first grade. The fourth-grade pupil knows how to write in order to express his thoughts and now merely needs drill in technique to develop the movement control which will enable him to write rapidly and accurately. We may therefore begin with formal movement drills — the repetition of the straight up-and-down stroke or the direct oval, for example — then develop the simple letters which are based on these drills and their combinations into words, and so on.

Practice on each of the several important types of movement drill shown in Fig. 5, page 101, with the appropriate small letters, may occupy several exercises. After the various drills have been gone through and reviewed they may form the introduction to each succeeding lesson. The capital letters may then be gone through in the same

way. Then practice may be given in forms of drill which exercise the lateral movement of the arm, such as those illustrated from Bennett or from Houston. While drill is being given upon the various classes of small and capital letters, various appropriate combinations of letters in words may be practiced. When the alphabets have been gone through once a greater proportion of the drill may be upon words and sentences so as to include a great variety of letter combinations. It may be of value to give especial attention to frequently occurring combinations, as *tion* and *ing*. The digits should also be practiced.

Another matter which should be given attention is the arrangement of the writing on the page. Spacing between letters, words, and lines, paragraphing, margins at the top, bottom, and sides should all be discussed and illustrated.

During this progress through the various kinds of movement drill some attention may be given to the form of the letters, but this feature of writing is bound to suffer for a time while the new type of adjustment is being learned. After the course as outlined above has been gone through the drill should be continued, giving more attention to the detection and correction of errors.

The causes of the errors made by each pupil should be discussed and removed, and a record of progress in speed and in the various characteristics represented in the writing chart to be described in the last chapter, should be kept.

The relation to be maintained between the speed of writing and its legibility or excellence of form may vary with the stage of advancement of the pupil. In practice it varies also between pupils in the same stage of advancement in different schools or school systems.[1] Thus, for example, in the fourth grade of one school the speed was found to be 60 letters a minute and the legibility (on the Ayers Scale) 50, while in the same grade of another school the speed was 83 and the legibility 42.5.

Style of alphabet. A relatively unimportant matter, but one which sometimes arouses question, is the style of alphabet which is to be used as a model for imitation. A simple form of script which is not extreme in any respect is the best. The letters should not be ornamented with flourishes or unduly simplified by leaving off

[1] See an article by the author entitled "Some Practical Studies of Handwriting," *Elementary School Teacher*, 1913, vol. XIV, pp. 167-179.

connecting strokes. Flourishes require time without increasing beauty and legibility. Elimination of connecting strokes decreases fluency. Again, too round a hand probably reduces speed, while too angular a hand reduces legibility. To go much further than this and prevent all individual choice by prescribing the exact form of every stroke is pedantry. The most important requirement of letters is that they be clearly distinguishable from each other. Deviations in the form of a letter, then, which destroy its distinctive form are to be discouraged. Others may be permitted.

The characteristics of the specific writing instruction which marks the introduction of intensive writing drill in the intermediate grades have been discussed. The course outlined will occupy perhaps a year. The succeeding year or two should be occupied in the fixing of the habits which have been built up by repetition with variation to suit the needs of particular classes or individuals. Three years of such drill should be enough, in the judgment of the writer, to produce a well-developed habit, provided the work has been consistent and has not been preceded by the formation of cramped finger movement writing in the early grades.

Handwriting in the grammar grades

The task in the grammar grades, then, is to prevent the pupil from falling into bad habits, gradually to increase the efficiency of his habit, and to complete the automatization of the habit.

Prevent the pupil from falling into bad habits. Bad habits of various sorts may be fallen into, and some attention is required to prevent their formation. For example, habits of bad posture may be contracted, due in many cases to writing without sufficient room on the desk. Or writing may become over-hasty. Or the proper relation between the arm and the paper may not be kept. Or excessive finger movement may be used. The habit once being formed does not guarantee that it may not be broken down, due to the stress of unfavorable conditions.

Increase the efficiency of his habit. In the second place, writing should be carried to a higher point of efficiency than is usually attained in the fifth or sixth grade, particularly in the matter of speed. The pupils at least who go on into the high school — and an increasing number are doing so — should be able to write easily and legibly one hundred letters a minute. Otherwise under the stress of note taking, theme writing, and writing

in tests and examinations they either will be at a serious disadvantage on account of their slowness or in their haste will disorganize their writing habit.

Make it completely automatic. In the third place, the writing habit should in these grades become as completely automatic as possible. That is, the child's attention should not need to be given to his writing movement or to the details of the letters except in so far as is necessary to see that they do not deteriorate, but should be free to be occupied with the thought which is being expressed.

Avoid continual experimenting with the style of writing. A great obstacle to the automatization of the writing habit is the practice of continually experimenting with it — not allowing it to settle down to a fixed mode of action. This does not mean that there should not be improvement, but that there should not be a radical shifting of the style of writing in any respect. Such shifting may be brought about by imitating the style of a new teacher, by a wave of fashion among the pupils throughout a school, or by an administrative change in method in a school system. As a matter of general principle such an administrative change should never be made to apply to the

grades above the fifth and ordinarily not in the fifth grade.

Use one style in both writing lesson and other school work. Another obstacle to automatization is the use of two or more styles of writing under different conditions. The pupil often uses one style for the writing lesson and another for the rest of his school work. This is probably due in large measure to the lack of responsibility of the regular teacher for writing and to her lack of competence to supervise it. This is a very unfortunate situation and it is a question whether it does not counterbalance the advantage of having skilled special writing teachers. Each pupil should possess a style of writing which is neither careless nor too precise, neither too fast nor too slow, and which can be used without substantial variation in all his work.

The method of meeting these demands. How may these demands be met in the upper grades? By occasional review drills and by holding the pupils definitely up to a standard in all their writing. Once a week is probably often enough for the drills which, by the way, could very advantageously be continued in the high school. A writing test could be given at the end of each drill period upon which the pupil could be graded.

Part of the penmanship grade, however, should be based on the pupil's written work in other subjects. Some exercise might be chosen each week, at random and without the pupil's knowledge which was to be selected, and the writing graded. This grade, of course, could be based only on form or quality, while in the writing test speed should also be taken into account. In addition to these methods a very good plan would be to refuse to accept any written work in any subject which failed to measure up to a certain minimum requirement. Due allowance should be made, of course, for individual deficiency in capacity.

In this chapter we have attempted to apply the principles which govern the writing act to the problem of teaching. We considered, first, the various matters connected with form in writing, the position of the hand, arm, and body, penholding, etc. Next were discussed the application of the principles governing the acquirement of the ability properly to execute the movement. Finally, the organization of the work in the various grades in the elementary school and its adaptation to the stage of progress of the pupils was outlined. Details of method, including some reference to current practice and to points of con-

troversy, have been taken up where they seemed to be most appropriate. This mode of treatment was chosen rather than the separate consideration of methods and of the organization of the work for the different grades in order to avoid unnecessary duplication. In this form we have put into practical application the analysis of the physiological and psychological principles which occupied the earlier sections of the book.

V

AIMS AND STANDARDS FOR HANDWRITING

THE purpose of handwriting is to serve as a means of the communication of thoughts to other persons. It is therefore a tool in the expression of thought. The most immediate concern of education with reference to handwriting is that the pupils shall develop this tool to the highest degree of efficiency which will justify the time and energy expended and that this shall be done in the most economical manner possible. From the practical point of view then we need to know what constitutes efficient writing and how it can be recognized or measured.

The qualities of excellence in handwriting

The excellence of writing may be considered from the standpoint of either the writer or the reader. From the one point of view we consider the economy of production and from the other, economy in recognition. In the past it has been the reader who has been chiefly considered. The monks of the Middle Ages toiled long upon a

single letter and produced manuscripts of great beauty and legibility. The modern school child has sometimes been taught as though the same ideal of achievement were suitable for him without regard for the fact that the monk was producing a permanent record which might be read over and over again while the modern writer is producing a temporary message which is likely to be read only once. In this case the time and energy of the writer are as much to be considered as are the time and energy of the reader.

The first thing we must know, then, in order to judge of the efficiency of writing, is the energy which was required to produce it. Since we cannot well measure the expenditure of energy directly, we have recourse to an indirect measure, namely, the time which is required to produce a given amount. Assuming that two persons put forth the same amount of effort and one takes twice as long to write one hundred words as the other, the one who takes double the time has expended double the energy. In so far as such expenditure is unnecessary it is waste.

Speed and its measurement

The first measure of the efficiency of writing, then, is speed. That this is not merely a theoreti-

cal consideration, but is of practical importance, is shown by the great divergence in the speed of writing among children of the same age in different classes or schools. Comparative measurements have shown that in some schools or school systems the speed is relatively above the quality of the writing when a certain relation between speed and quality is assumed as a standard. This method of comparison is illustrated in Fig. 11, page 145. In other cases the speed is below the quality, and in still other cases the two run closely together. The same divergences appear if we compare different grades in the same school or system.

It is apparent, then, that speed is sometimes developed at the expense of quality, and *vice versa*. But we cannot assume that low speed is always accompanied by good quality or that high speed always implies poor quality. There is no constant relationship between the two characteristics of writing. Sometimes, for example, there is high excellence in both respects and sometimes there is deficiency in both.

If we wish, then, to gain an accurate notion of the efficiency of the writing of any child or group of children, we must measure the speed of their writing. This measurement is simple in

principle, but in order that it shall be reliable certain precautions must be taken.

The following form of procedure is recommended. First in regard to the matter which is to be written. Since our aim is to measure merely the speed of writing and not the speed of the thought process, the writing should not be interrupted by the necessity for reflection. That is, the child should memorize thoroughly what he is to write so that he may write continuously. Again, when a test given at one time is to be compared with a test given at another time, the material should be as similar as possible in the two tests, though not identical. For this purpose it would be well to select a poem of uniform character and require the child to memorize it at the beginning of the experiment. One stanza should then be used at the first test and the second stanza at the second test, etc. If the child finishes the stanza within the specified period he should begin it again and so continue until the end of the period. At the end of the experiment it would be well to have the child write all of the stanzas at one time in order to find out whether they are of equal difficulty or not.

A three-minute period will be found of convenient length for a test. The children should have their paper and pens ready to write at the signal from the teacher. They should then write continuously until the signal to stop is given. Either after or before the test each child should write his name, age and grade upon the paper.

The manner of giving instruction for the test is important. It has been found, for example, that the result will vary greatly according as the child thinks that the speed of his writing or the quality is being tested. If, now, we are endeavoring to secure his ordinary writing we must be careful to avoid giving the impression that we are testing particularly either speed or form. For this purpose some such instruction as the following might be used. Without telling the child at all that he is undergoing a test, one may say: "Write the first stanza of the poem which you have learned. Write it just as you would in a composition or an ordinary school exercise. If you finish before the end of the time, begin and write it over again. Begin to write when I say 'Now' and stop when I say 'Stop.'" It would be well to carry on a preliminary experiment in order to be sure that the children understand the instructions.[1]

The quality of the written product

So much for the determination of efficiency from the standpoint of the writer himself. The reader must also be considered. So soon as we get beyond the judgment of the ordinary observer and attempt to determine differences in excellence more precisely it becomes necessary

[1] From an article by the author entitled "Problems and Methods of Investigation in Handwriting," in *The Journal of Educational Psychology*, 1912, pp. 181–90.

to answer the question regarding the features of writing which make it good or bad. The more exactly we answer this question the more likely we will be to agree with others or with ourselves at different times as to how good a particular specimen or set of specimens is. Another reason why the settlement of this question is important is that it will make it possible to set before the pupil a definite goal of attainment. We can then say to the pupil not only, "Your writing is poor. Make it more like the copy," but we can point out to him just in what ways it is poor and needs to be improved in order that it may resemble good writing.

Uniformity

One of the characteristics which is most obviously related to excellence in writing is uniformity. Lack of uniformity detracts from the good appearance of writing and in some measure from its legibility. There are two aspects of writing in which lack of uniformity may be readily detected and measured. These are the slant and alinement of the letters. We may confine our attention to the two or more space letters in judging uniformity of slant and to the one-space letters in judging uniformity of alinement.

The charts for grading uniformity and other characteristics

In order to illustrate different degrees of excellence in these and in other characteristics about to be mentioned, and to make it possible to grade writing according to the degree to which it possesses them, a series of charts has been constructed, which is reproduced in the Appendix to this monograph. Each chart represents three degrees of excellence, the lowest one being numbered 1 and the others 3 and 5 respectively. The intermediate numbers 2 and 4 may be used when the specimen to be judged seems to belong about midway between the ranks above and below it.

The specimens for these charts have been selected in the following manner: A large number of specimens of the writing of children in grades three to eight were examined and classified into as many ranks as could be readily distinguished, according to each of the characteristics or categories which are represented on the scale. In some cases four ranks were distinguished and in the others five. This, then, formed a tentative scale. This tentative scale was then used as a guide by twenty-three advanced students in grading one hundred specimens into ten ranks

according to each category. The one hundred specimens were selected from a large number of specimens of writing of children of the same grades as before so as to get so far as possible representatives of the different types of writing and grades of excellence. It was then found possible to select specimens which should represent ten approximately equal steps for each category on the basis of the average judgments of all the graders.

The scale which was thus based on the simple judgment of a number of competent judges, even when the judgments were simplified by tentative scales to be used as models and by the concentration of attention on a single attribute at a time, did not, however, produce entirely satisfactory results. This appeared clearly in two cases in which the judgments of the graders could be checked up by objective measurement, namely, in the uniformity of slant and of alinement. It was only necessary to measure the average deviation of a number of letters in each specimen to determine that the order in which they were placed by the rather consistent judgment of the graders departed widely from the true order.

The scale was then remodeled by basing the order of the specimens so far as possible on an

objective measurement of the characteristic in question or at least employing some means to exaggerate the characteristic so as to make judgment easier. How this was done in each case will be described in connection with the discussion of the different qualities which form the basis of the scale.

If the unaided judgment of the grader was not sufficient in the construction of the scale neither can it be expected to be sufficient in using it. In the case of each section of the scale then some device is employed to emphasize or even exaggerate the characteristic to which attention is to be given.

Furthermore it cannot be too strongly asserted that the analysis of the excellencies or defects of writing cannot be satisfactorily made except by one who has had some practice in the matter and who has made himself familiar with the characteristic differences which are to be found. The unpracticed observer in this as in other fields simply does not see the differences which must be taken into account. The purpose of the scale which is here represented is to serve as a guide to the teacher or other observer in learning to detect differences in the elementary characteristics of writing and to furnish him with a series of numerical designations by which he may express

his judgments. By this means a permanent record may be made of the judgments which are passed, and they may be compared with judgments passed upon other specimens.

Uniformity of slant

To return to the category uniformity of slant. By reference to Chart 1 in the Appendix it will be seen that three degrees of uniformity are represented. In order to make prominent the feature which is to be estimated lines are drawn parallel to the down strokes of the two or more space letters, which may be used as the basis for the judgment. The amount in degrees of the deviation from uniformity as expressed by the average deviation is given in the column to the left of each specimen under the caption M. V. The judgment upon a specimen should be recorded in terms of the rank which seems most closely to correspond to it in the scale. It will be noticed that the amount of difference between ranks 1 and 3 is greater than that between ranks 3 and 5. The reason for this difference is that it is presumably easier to distinguish differences in variability when the uniformity is high than when it is low. The same assumption is made in the case of uniformity of alinement.

In order to render the judgment of the uniformity of slant in the specimen to be graded easier, in somewhat the fashion that comparison of the specimens in the scale is facilitated, the lines of Fig. 13, page 151, may be traced on a sheet of transparent paper. If the series of parallel lines which most nearly resemble the slant of the writing to be judged is placed above the writing, the degree of deviation can be estimated by comparison with the standard lines.

Uniformity of alinement

Uniformity of alinement is represented in Chart II. Uniformity is measured with reference to the tops and bottoms of the one-space letters. The degree of deviation was calculated on the basis of the average deviation in the distance of these points from a straight base line. As in the case of uniformity of slant, guide lines are drawn to make it easier to detect the amount of deviation. A guide line is also supplied in Fig. 13, which when traced may be placed over the specimen to be judged. As in the case of uniformity of slant the judgment should be recorded in terms of the rank of the corresponding specimen in the chart.

A difficulty arises in judging uniformity of alinement due to the fact that deviations are more

striking when the letters are close together than when they are spread farther apart. This may be seen by comparing the specimens of rank 2, both of which have the same average deviation. The use of a guide line overcomes the difficulty to some extent, but not wholly. It must also be consciously guarded against.

Quality of the line or stroke

A third important characteristic of writing is the quality of the line or stroke by which the letters are produced. The stroke may be smooth, firm, and even; or it may be tremulous, weak, and irregular. The one kind of stroke inevitably suggests a smoothly flowing, free, and regular movement, and the other an uneven, jerky, cramped movement. The differences, however, are not always easy to detect, and in order to make them more evident portions of each specimen in the chart (Chart III) are enlarged. After the enlarged records have been examined the irregularities may be made out in the originals. If further assistance in grading is desired the writing on the specimens to be graded may be enlarged by means of a reading glass.

The quality of the stroke is important not only for what it indicates of the character of the move-

ment but also because it affects the beauty, and to some degree the legibility, of the writing itself.

Excellence in the qualities of uniformity and character of the line is based chiefly on the possession of a well-coördinated writing movement, and deficiencies in these regards are to be overcome largely through the acquirement of an easy, fluent, regular movement. That is, mistakes in these matters are to be corrected more by attention to the movement than by fixing attention directly on the writing itself. Irregularities in slant, for example, are due to the fact that in making succeeding strokes the hand or arm is not in the same position. Sometimes the variations in position and the accompanying shifts in slant occur frequently and at irregular intervals; and sometimes the slant is uniform for a number of words, or even lines, and then there is a sudden change. There is also one other type of change in slant which is due, paradoxically, not to a change in the manner of holding the hand or arm, but to the maintenance of the same position. This is the increased slant which occurs at the end of the line. This type of variation was discussed in a former chapter.

We have next to consider two features of writing which are not so immediately related to the

character of the writing movement. That is, their development is brought about not so much by giving attention to the perfection of the movement as by giving direct attention to the letters and words which are produced by the movement. The two features which come under this head are letter formation and spacing.

That there are these two classes of qualities in writing, one of which is to be developed by giving attention to the movement and the other by considering the character of the written product, is not always recognized. Some would trust for the amelioration of all writing evils to the development of the right sort of movement, while others would allow movement to develop in a hit or miss manner in the process of trying to produce well-formed letters. The distinction here drawn implies that neither of these methods by itself is adequate.

Letter formation

Letter formation is the matter to which the child's attention has been chiefly directed in the traditional methods of teaching. It still is of more importance than any other one feature, and we shall express this superior importance by giving it double weight in the final score. Hence in

Chart IV the three ranks which are represented are designated 2, 6, and 10 instead of 1, 3, and 5, and the intermediate ranks should be numbered 4 and 8 instead of 2 and 4. This increased weight given to letter formation is justified by the fact that the form of the letters is the fundamental basis of legibility.

The task of grading letter formation presents peculiar difficulties which are due to the confusion between fundamental and universal features of the form of a letter and those features which are peculiar to a particular style of alphabet. Thus, for example, in some copies which are set up as a standard the second up stroke of the *m* or *n* leaves the preceding down stroke immediately, while in other styles it follows the down stroke for half or more of the way up. Now it seems obvious that in any method which is to be used in judging any style of writing, as is the case with this method, only those characteristics of the letters which are universal and essential must be considered.

One principle at least is clear as governing letter formation. No letter should vary from its conventional form in such a way that it is likely to be confused with another letter or to lose its characteristic form. It is not always easy to de-

termine whether a particular deviation from the conventional form is detrimental to the ease with which the writing can be read or not. In general we may put the burden of proof on the person who makes the deviation, and if there is doubt incline to the view that the deviation should be discouraged. There are many deviations, however, which clearly do not render the writing less legible and it is pedantry to seek to prevent them. Every adult writer who uses his pen much falls into ways of making the letters which are more or less peculiar to himself, and there is no reason why children should not be allowed the same privilege provided they do not shift too often from one style to another.

The figure on page 135 (Fig. 9) illustrates a large number of typical errors arranged according to the order of the letters in the alphabet. A number of common principles may also be traced among groups of letters.

A frequent fault which is common to a number of letters consists in leaving a loop open which should be closed or closing a loop which should be open. This is illustrated in the specimens of the letters *a*, *d*, *f*, *g*, *o*, *q*, *s*, and *v*. Sometimes the legibility is seriously affected by the fact that the stroke runs higher or lower than it should. This

may affect only part of the letter or it may make the whole letter too large or too small. Examples appear in the second *b*, the second *f*, the *j*'s, the second *k*, the second *l*, the second *n*, the second *o*, the first *q*, the second *y*, and the *z*. The confusion due to size commonly occurs when the capitals are made like the small letters, as in the case of the *A*, *C*, *G*, *M*, *N*, *O*, *Q*, *S*, *U*, *V*, *W*, *X*, *Y*, and *Z*. (These are not shown in the figure.) Often an important part of the letter is slurred over so as to cause it to lose its characteristic form, as may be seen in the figure in the case of letters *b*, *h*, *c* (first specimen under *i*), *k*, *q*, *r*, *s*, *w*, and *y*. The substitution of angles for curves and *vice versa* is illustrated in the *m*, the *n*, and the *u*. The substitution of loops for return strokes along the same line or the reverse is seen in the letters *c*, *d*, *e*, *f*, *i*, and *t*. Sometimes a return stroke is substituted for an open curve or an open curve for a return stroke, as in the first *r*, and the first *v*. Finally, a stroke may have faulty direction or be misplaced, as in the second *t*, the first *u*, or the *x*'s, or the spacing may be irregular, as between the first *c* and the letter following it.

The chief consideration which is at the basis of the foregoing analysis of errors in letter formation is legibility. The factor of beauty must also

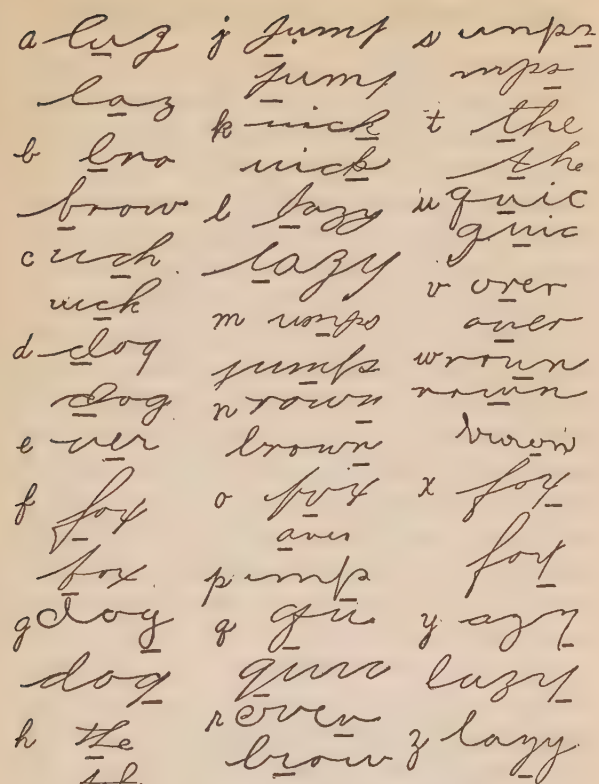


FIGURE 9

Illustration of gross errors in letter formation.

be taken into account. From this point of view a letter may be easily distinguishable, but may not be pleasing because it does not conform to its type. We should be getting on debatable ground if we should attempt to choose between different types of script, but it is clear that whatever type is used, the individual letters should conform to it. In other words, the letter formation should be consistent. Strokes of the same nature, for example, should be made in the same way. Thus the similar strokes of the *h*, *m*, *n*, *p;* of the *a*, *d*, *g*, and *q;* of the *i*, *u*, *v*, *w*, should be alike in fact as well as in theory if the writing is to present the most pleasing appearance. What degree of excellence we should require of the average pupil in the elementary school is a question to be determined, but it is certain that letter formation as here defined is an element of writing excellence.

These two factors in letter formation taken together, legibility and beauty, constitute the basis of grading in this characteristic. In this, as in the other characteristics, three grades of excellence are represented in Chart IV. The specimens were graded independently by two methods, and their final rank was determined by combining the results of the two methods. First, ten specimens were chosen from the one hundred

which had been ranked by the twenty-three judges so as to represent approximately equal intervals. Then these ten specimens were ranked by a method of detailed analysis of each letter in which the faults of each stroke were counted.[1] These faults are indicated on the chart by small arrowheads. The results of the two methods were expressed in terms of percentage and averaged. The average percentages, based on a range of 0 to 100, are given in the column at the left of the specimens. It will be seen that the gross errors illustrated in Fig. 9 are relatively infrequent in the specimens of the scale. They occur only in the most careless writing, and in order to distinguish any but the lowest degrees of excellence we must employ the more minute analysis such as is illustrated in the chart.

Spacing

There remains a fifth feature of writing which has a very important bearing on its quality, both from the point of view of legibility and of beauty, and that is spacing. We may confine

[1] This work was done by Mr. R. R. Simpkins, of the State Normal School at Macomb, Illinois, whose service the writer gratefully acknowledges. Mr. Simpkins used a system of marking devised by himself.

our attention to spacing between letters and between words, although the space between lines is also of great importance. Line spacing, however, is usually determined for the child by the fact that he writes on lined paper. Furthermore, while crowding the lines together is a serious fault, it is not difficult to correct.

The three faults in spacing between letters and words which are of importance are first crowding the letters, second, spreading them too far apart, and third, crowding the words. The fourth possibility, that of spreading the words too far apart, is not so frequently found, nor does it seriously detract from the quality of the writing. These faults may exist alone or singly. To illustrate them a scale, Chart v, has been artificially made by constructing specimens in which the spacing is correct, or in which faults of spacing exist singly or in combination. Those specimens which have one fault are placed in the middle rank and those which have two are placed in the lowest rank.

The correct spacing for three different styles of writing was first found in the following manner. Fifteen persons were asked to judge what spacing between the letters and words in the specimens was most pleasing. The spacing was varied by

a device which need not be described here. The median of their judgments was then taken as the most satisfactory spacing. Variations in the spacing of these specimens were then artificially produced by the use of tracing paper and in this way the specimens of ranks 3 and 1 were produced. The representation of these various possible variations from the standard serves as a guide in discovering the kinds and degrees or variations in the samples to be judged and makes it possible to give them an appropriate rank.

When a specimen has been given a rank in each of the five characteristics a total grade may be given it by adding the individual measures. This gives equal weight to the different characteristics except letter formation, and until we have further evidence than is now at our command regarding their relative importance this is the best we can do.

Grading a specimen for illustration

The procedure of grading a specimen of writing by means of the scale may be made clear by grading the sample specimen shown in Fig. 10. The slant of this specimen is rather variable. It grades not over 3. Uniformity of alinement is also very low. See for example the variation in

the words *sweet* and *land*. The specimen deserves but rank 2 in this characteristic. Quality of line is equally poor and receives also rank 2. The formation of the letters is better, though it is affected by the irregularities which have been already noted. We may grade letter formation by the middle rank, 6. Spacing is the strongest point of the specimen and deserves a rank of 4. The rank of the paper then is: Uniformity of slant, 3; uniformity of alinement, 2; quality of line, 2; letter formation, 6; and spacing, 4; total, 17. It is clear from this analysis what the chief trouble with this specimen is. It grades low in those characteristics which depend primarily on the character of the writing movement and higher in those characteristics which depend more on the recognition of the form of the written words. What this pupil needs is the acquisition of a smooth, well-coördinated movement.

The fundamental aim of this scale is to assist the teacher to pick out and to designate in numerical terms the degrees of excellence of each pupil's writing. It is primarily for the use of the teacher. The teacher has to lead the pupil to a correction of his faults, not merely to tell him how bad his writing is. The teacher must therefore be able to discriminate one kind of fault

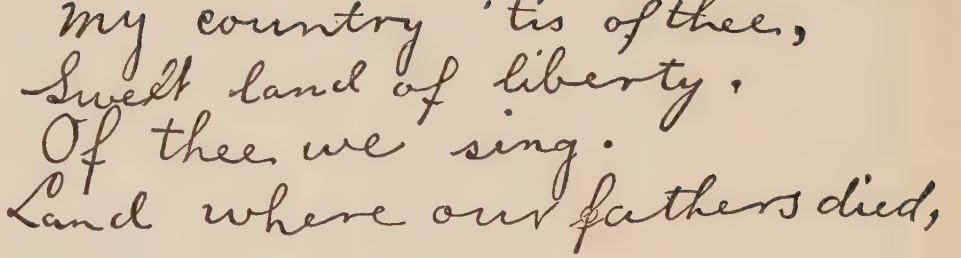

My country 'tis of thee,
Sweet land of liberty,
Of thee we sing.
Land where our fathers died,

FIGURE 10

from another. She must also be able to keep a record of the pupil's advancement, not merely in a general way, but also in respect to the various elements of his performance. The time is coming when the pupil will have definite standards of attainment set up before him and when his progress toward those standards will be carefully recorded and revealed to him. Probably also when the pupil has reached the standard of attainment in a particular branch he will be relieved of further work in that line, regardless of the grade he may happen to be in. The necessary preliminary to this condition is the possession of means of definitely determining in a discriminating way what the pupil's attainment is. To serve such a purpose for writing is the aim of this scale.

Standards of attainment

The pupil's progress and his ultimate attainment should be judged, then, not on the basis of the comparison of his work with that of his classmates, but rather by a comparison of his work with a standard of achievement. It therefore becomes necessary to determine upon a standard which can reasonably be required. If such a standard is necessary for the rational grading and promotion of the individual pupil, it is still more

obviously required for the purpose of judging the efficiency of teachers or the value of particular methods of teaching.

For the determination of a rational standard of achievement in writing in the grades, several inter-related factors must be taken into account. In the first place, we must know what are the limits of attainment of ordinary pupils of various grades or ages under the best teaching to be found. If we have reason to conclude that the maximum of attainment possible is nowhere reached, we may perhaps place the standard above anything that is actually found. We are never justified, however, in placing the standard below what has been actually attained and has therefore been proven to be possible of attainment. The average of attainment in the public schools in general cannot therefore be regarded as a valid standard.

This principle of maximum attainment possible may be applied to a comparison of lower and higher grades as well as of different schools or systems. In this connection, it may be stated thus: the maximum attainment in any grade is to be taken into account in judging the attainment of the succeeding grades. In other words, every grade may reasonably be expected to reach

a higher standard of attainment than the preceding grade.

The second general principle which must be taken into account in setting up standards is that the value of any particular degree of attainment must be judged in relation to the amount of teaching and learning time which is required in order to reach it. In this connection, we must consider particularly the law of diminishing returns in practice. After a certain amount of time has been spent on practice, the expenditure of additional time does not result in a proportionate gain in efficiency. A slight superiority in attainment in writing which is purchased by the expenditure of a large amount of extra time is not profitable unless such superiority is found to be essential.

This brings us to the third principle, which is that the amount of time which it is worth while to spend and the degree of efficiency which it is worth while to attain is to be judged in view of the social demand for this particular product of education in comparison with the demand for other products. This social demand must, of course, be viewed in the broadest way and must not be confined to the narrow industrial or commercial demand.

We have not yet sufficient data for a complete

application of these principles to writing,[1] but they may serve to guide us in setting up tentative standards. The best results for our purpose which have been published have been attained

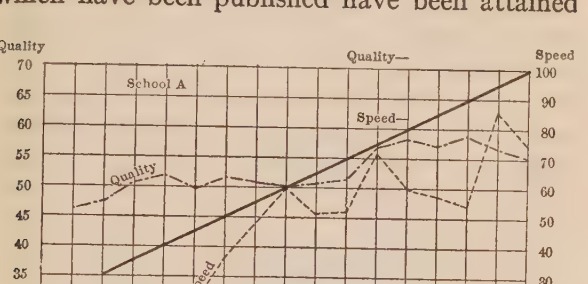


FIGURE 11

by the schools in Connersville, Indiana, as reported by Superintendent Wilson.[2] The data are presented graphically in the accompanying chart (Fig. 11).

The two dotted lines marked quality and speed

[1] The writer is now engaged in an investigation for the Committee on Economy of Time of the Department of Superintendence which will give more detailed facts on which to base conclusions. The results will be published in the 1915 Yearbook of the National Society for the Study of Education.

[2] G. M. Wilson, "The Handwriting of School Children," *Elementary School Teacher*, 1911, vol. XI, pp. 540-43.

represent the attainment of the various grades in the first test given. Quality, which has been put in terms of the Ayers Scale,[1] is to be read by reference to the figures on the left margin and speed in terms of letters per minute by reference to the figures at the right. After the test an effort was made to improve the writing, particularly in speed. The result of the effort is presented for grade 6A, and is indicated on the chart by the horizontal strokes on the column for grade 6A marked "quality" and "speed." The heavy black line running diagonally across the chart represents a proposed tentative standard and may be discussed on the basis of the principles and facts which have been presented.

With the data at hand we can apply most completely the first principle which is concerned with the best attainment to be found. It will be seen that the school system represented in the chart comes up to the tentative standard as far as grade 4A, if we strike an average between speed and quality. The speed in the case is obviously too slow and raising it would probably bring down the quality in these lower grades. Above grade 4A the actual performance in the first test

[1] L. P. Ayers, *A Scale for Measuring the Handwriting of School Children*. Russell Sage Foundation Publications no. 113.

is below the standard, but in grade 6B the standard is almost reached. Beyond this grade no progress was made. That this condition, which violates the general principle laid down above, is unnecessary is shown by the great improvement which was made after the test in both speed and quality by grade 6A, which brought this grade considerably above the standard. It is reasonable to suppose that the other grades could do proportionately as well.

The objection may be made that while the standard laid down, which requires the ability to write one hundred letters a minute with a quality equivalent to grade 70 on the Ayers Scale at the conclusion of the eighth grade, is possible of attainment, such a degree of attainment is not worth the effort necessary to reach it. We do not know the time which was spent in teaching writing in the school system under consideration, but there is no reason to think that it exceeded the average, which is about fifteen minutes a day. For many occupations certainly the standard is not merely not high, but it is low. Thus for the clerk, the bookkeeper, the agent or superintendent who must make out reports, the small business or professional man who writes his own letters, the teacher, etc., a fluent and legible

style of writing is essential. What proportion of eighth-grade graduates enter these occupations, we do not know, but some estimate can be made for the larger cities from a table compiled by Ayers.[1] He found that thirty-four per cent of the fathers of elementary school children were classed as clerks and salesmen, managers, superintendents and proprietors, and professional and financial workers. In addition, forty per cent were classed as artisans and industrial foremen, and a large number of these should be able to write well. Furthermore, the pupils who enter high school, who form thirty-five per cent of the school population according to Strayer's estimate in the article on "Retardation and Elimination" in the *Cyclopedia of Education*, have much use for rapid and legible writing.

It should not be inferred from the preceding discussion that the eighth-grade standard as set forth above represents either very good or very rapid writing. A glance at the specimens of grade 70 on the Ayers Scale will convince the reader that the form is not excessively good. That the rate of 100 letters a minute is not excessive for the eighth grade is shown by the fact

[1] L. P. Ayers, "Factors affecting Industrial Education," *Elementary School Teacher*, 1914, vol. XIV, pp. 313–18.

that the sixth grade of one school which the writer investigated wrote at the average rate of 114 letters a minute without falling below the average in quality.

The discussion of standards thus far has been in terms of the Ayers Scale, since the measurements have been made in terms of either this or the Thorndike Scale.[1] For the convenience of those who may use the scale described in this book for teaching purposes, and who may wish to use the results which are obtained with it to compare their grade or school with the standard, a second standard has been worked out in terms of the analytical scale described in this chapter which is approximately equivalent to the standard presented above. (See Fig. 12). The equivalence of the two standards was worked out by grading the same set of papers by the two scales.

The way in which an absolute standard of attainment such as is here set forth may be used in the grading and promotion of individual pupils has already been incidentally suggested. Every test of the ability of pupils in handwriting brings out the fact of a large amount of overlapping of the successive grades. Many children are supe-

[1] E. L. Thorndike, "Handwriting," *Teachers College Record*, 1910, vol. IX, no. 2.

rior in attainment to the average of attainment of several grades above them. If the children were given an additional incentive to improvement by

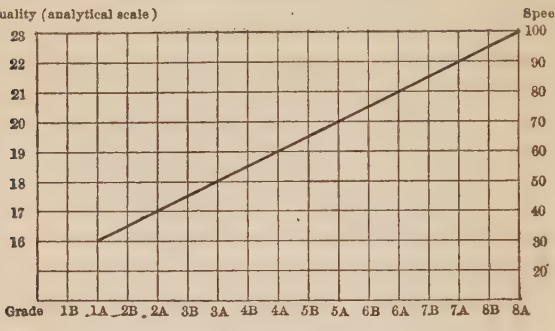


FIGURE 12

being granted exemption from the writing lesson or promotion to a higher grade in writing as soon as they had attained the standard of the second grade above them, many of them would soon, in all probability, attain this degree of efficiency. We can do no more here than suggest the possibilities of this type of application of an educational standard in solving the problem of waste in education. The suggested solution rests upon the practice, first, of setting up definite standards of attainment, and, second, of furnishing the pupil adequate incentives to come up to the standards.

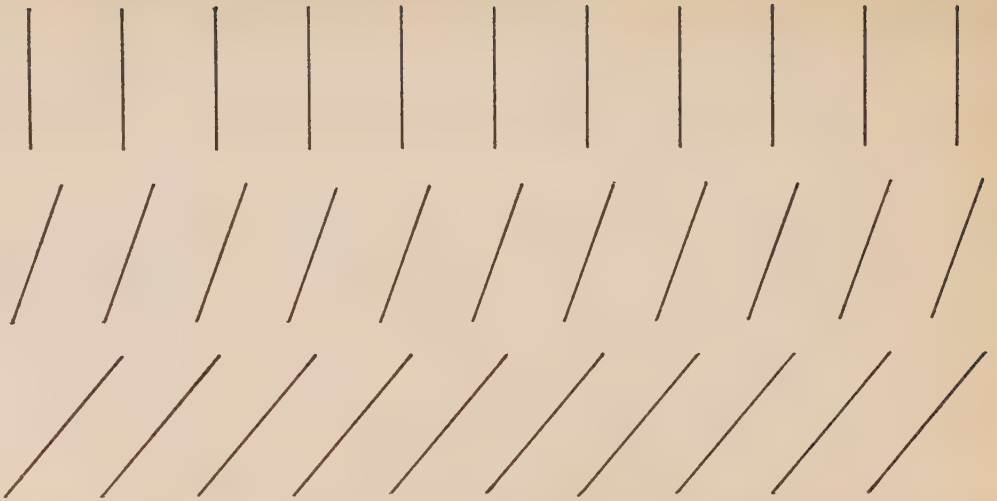


FIGURE 13. *This may be traced on transparent paper for use in grading uniformity of slant and alinement*

OUTLINE

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4. Psychology, physiology, and hygiene involved . 4

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APPENDIX

The five following Charts for Diagnosing Faults in Handwriting are also printed separately and sold as a Broadside

A quite brown fox Jump

over the lazy dog

Chart II. Uniformity of Alinement

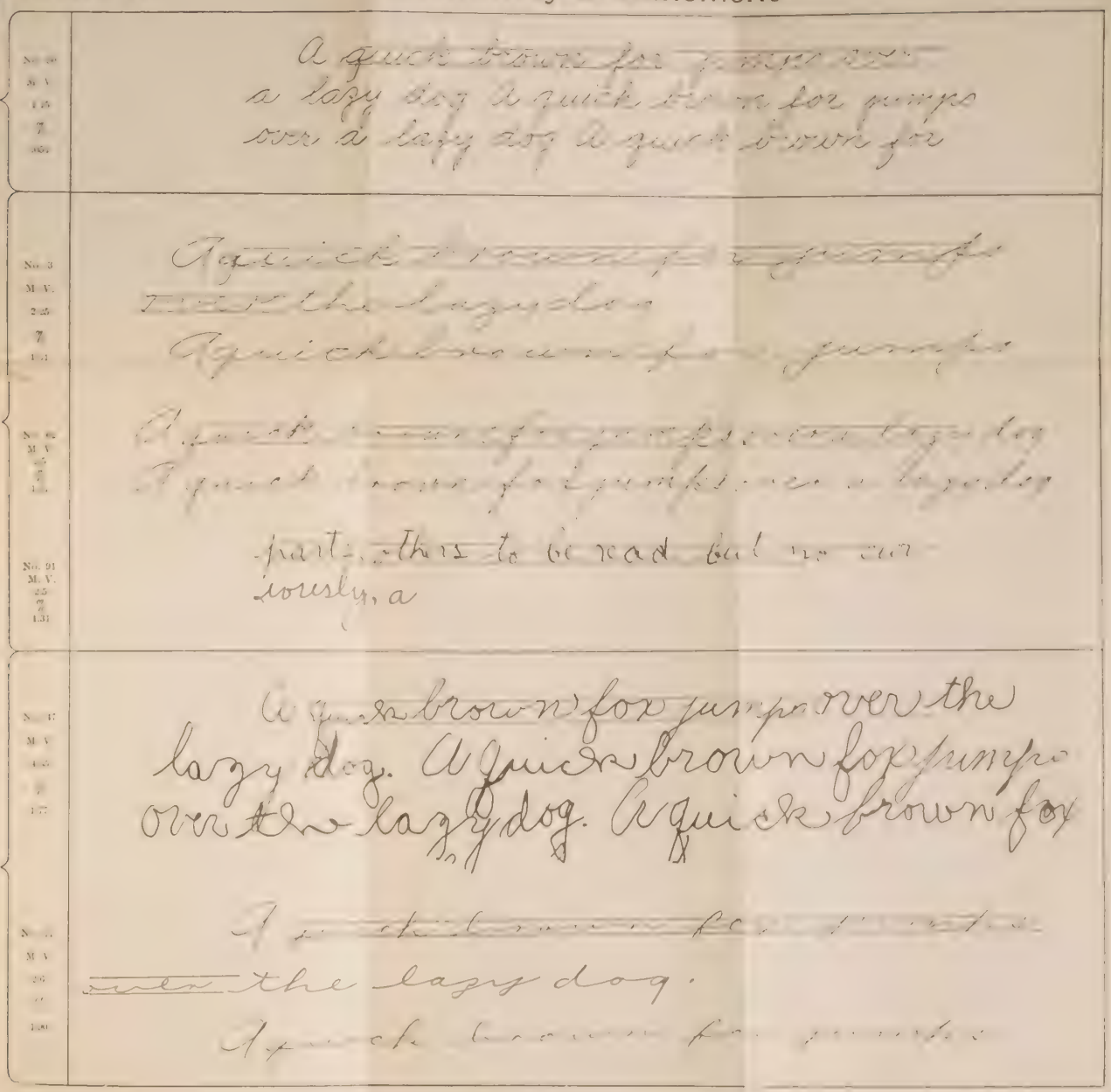


Chart III.

Quality of Line

No. 28

dog
A quick brown fox jumps
over a quick brown fox jumps

dog
A quick-

Where is the true man's
fatherland?
Is it where he by chance

fatherla
where he

No. 29

A quick brown fox jumps
over a lazy dog

A quick

No. 30

Some books are to be
tasted, others to be swallowed
and some few to be chewed

others to

No. 31

A quick brown fox jumps over a
lazy dog

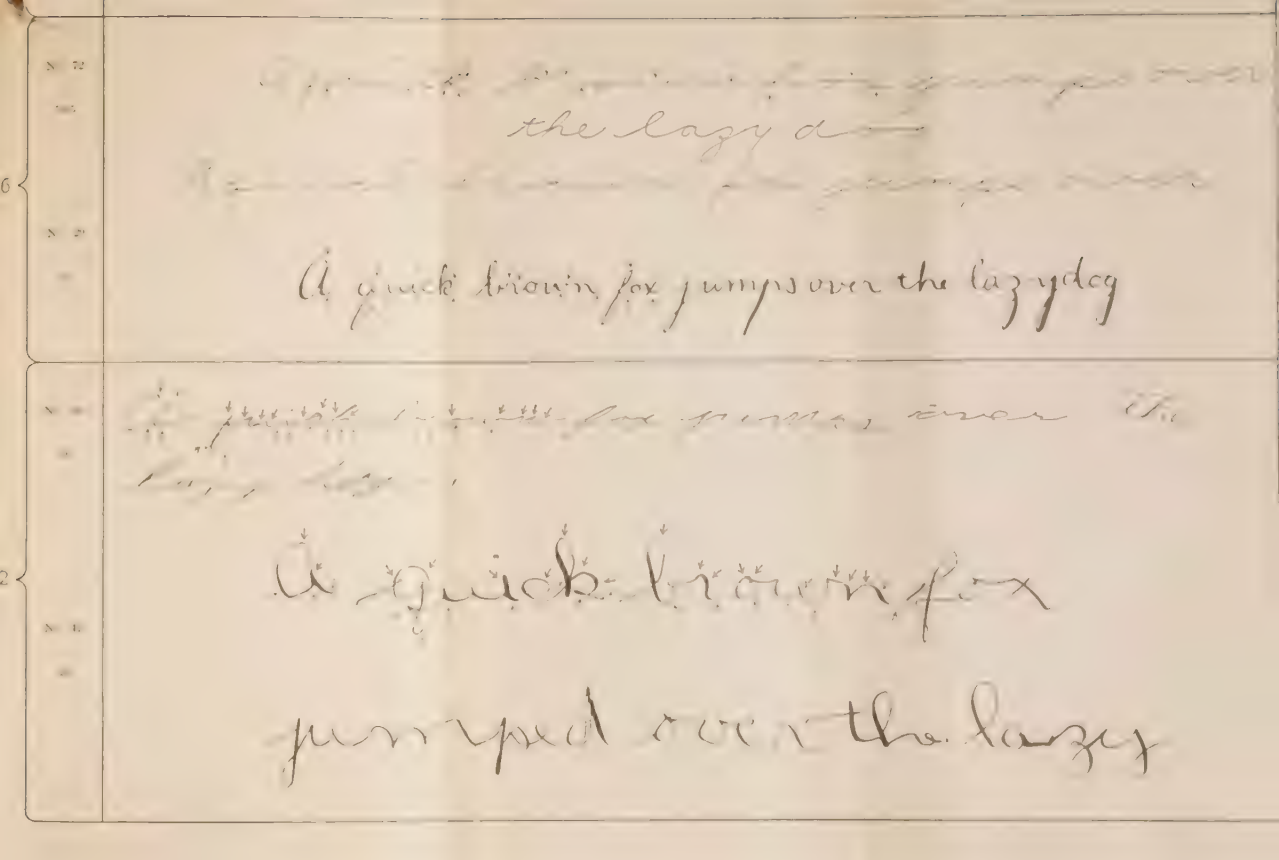
A quick brou

No. 32

A quick brown fox jumps over a lazy dog

A quick

In the reproduction of this chart the lines have become smoother. This modification is particularly marked in the case of the poorest specimens. In using the chart, therefore, an allowance should be made for this fact.



A quick brown fox jumps over

A quick brown fox jumps over the

A quick brown fox jumps over the

A quick brown | fox jumps over

A quick brown fox | jumps over the

A quick brown | fox jumps over the

A quick brown fox jumps over

A quick brown fox jumps over the

A quick brown fox jumps over the

A quick brown fox jumps over

A quick brown fox jumps over the

A quick brown fox jumps over the

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